

Aviation Week & Space Technology

May 21, 1962

SPECIAL REPORTS:

- 624A-Titan 3 Program
- Saturn Tanks

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Mercury/Rogallo-Wing Test



LTV PRESIDENT JOHNSON... "A NEW BRAND OF EFFICIENCY"

Ling Temco Electronics and Chance Vought Corporation are now consolidated into a new industrial force — Ling-Temco-Vought. Representatives have been assigned to add new vigor and manufacturing and R&D efforts have been reorganized to gain maximum benefit from the total resources made possible by the creation of LTV. Also essential lines have been eliminated markets are being carefully defined, and company procedures have been streamlined so that LTV now operates with a new brand of efficiency in product areas that range from rockets for defense and space exploration to consumer use vehicles, etc. Responsibility for consolidating the company's 20,000

employees and great material resources rests on the shoulders of a management team headed by LTV President Gifford Johnson. A vital component in LTV management in depth, Gifford Johnson has nearly 27 years' experience as an aerospace executive. Beginning with a West Coast aircraft company in 1936, he climbed steadily from material and production manager at Chance Vought; in 1950 to company president (in years later by assuming this earlier of management with proved tactical competence in aerospace, electronics, telecommunications and consumer products, LTV is making important new contributions to national defense, space exploration and domestic progress.

LING-TEMCO-VOUGHT, INC. **LTV** DALLAS, TEXAS



AEROSPACE CALENDAR

- May 25—Symposium on Recent Developments in Gyroscopic Sciences, Institute of the Aerospace Sciences, Los Angeles
- May 26-June 2—14th Annual Wright Memorial Glider Meet. For information: Boeing Society of Dayton, Inc., 1414 Bessie, P. O. Box 51, Dayton 19, Ohio
- June 4-1962 Nuclear Congress, Seattle (Bism Hotel), New York, N. Y.
- June 6-7—Symposium on Standards for Future World Warhead Production, Naval Ordnance Laboratory, Ytates Oak, Md.
- June 6-8—English Annual Subject Symposium (planned) aerial Institute of Science and Technology's Radio Laboratory, University of Michigan, Ann Arbor
- June 7-8—Trade Showdown, Utah, Chance Vought, Aerospace Products, Seattle, Wash.
- June 8-15th National Maintenance and Operations Meeting, Boeing-Vought Service Inc., Reading, Pa.
- June 16-18—16th National Conference, National Aviation Education Council, Seattle, Wash.
- June 19-24—Annual Meeting, Heat Transfer and Fluid Mechanics Institute, University of Washington, Seattle, Wash.
- June 27—28th Annual General Meeting, American Institute of Aeronautics Engineers, Denver Hilton Hotel, Denver, Colo.
- June 28—Vacuum Metallurgy, Charleston, American Vacuum Society, New York University, New York, N. Y.
- June 18-Aug. 18—Advanced Subject Matter Institute on Nuclear Rocket Propulsion, (Continued on page 7)

AVIATION WEEK and Space Technology

May 25, 1962
Vol. 76, No. 21

Aviation Week and Space Technology is a leading authority on the latest developments in the aerospace industry. This issue contains a wealth of information on the latest in aircraft design, space exploration, and military technology. The article on the X-15 hypersonic aircraft discusses its record-breaking flight and the challenges of high-speed flight. The space section covers the progress of the Apollo program and the development of new spacecraft technologies. The military section explores the latest in missile defense and strategic defense systems. The issue is a must-read for anyone interested in the latest in aerospace technology.

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(Continued from page 9)

[illegible]

(Or: Elephants, eggs and high-information inputs)

"What's the difference between an elephant and an egg?" asks a children's riddle. "If you do not know," goes the pointed reply, "I would not want to send you for eggs."

Leaving you to decipher the analogy between this and what follows, we'll say simply, but emphatically, that it's time for some fresh thinking about the kind of systems (or personal pattern recognition techniques we'll need to devise hardware that knows how to learn.

Work has been done. But in approaching now the question of how a machine might recognize and separate things presented to it in pictorial form, we started at the beginning.⁸ This led to an untraditional but most promising path.

Previous work has dealt mainly with inputs containing relatively little information. In these cases recognition can involve merely comparing the actual input with a single case of every possible input. Instead of such simple matching, inputs can be described by a limited number of easily measured geometrical parameters. The hard task is that these

inputs having complex high information content, such as photographs taken from aircraft or satellites.

When the picture involves more than comparatively clean-cut shapes or patterns that can be easily extracted from the background, the matter of identifying which figure is present has to take a back seat to the problem of teaching the machine to recognize which part of the picture

is the figure and which is the "ground." The number of possible windows facing the machine is obviously not, if not infinite.

The techniques we've presented start with statistical analysis of input images. Having long attained the use of statistical measurements for making absolute recognition decisions, we've now applying them to establish a basis for figure-ground discrimination—to determine the boundaries of conspicuous figures in the image, and to generate a simplified description of the "visual texture" of the image. Our approach has the exciting virtue of being generally applicable to high-resolution, input abstracts—striking photo interpretation, automatic target recognition, aerial detection, automatic cloud cover analysis and you name it.

The executive board of our Recognition Systems Group has prepared an introductory study on the subject, which we'll send absolutely free to the first 2,512 readers who ask for it. You'll also receive your membership in our Inland Chapter and Marching Society, if you haven't yet joined.

Better still, let's get together for sit-a-tink, where the discussion on *just* over into video bandwidth reduction, solid state display devices and any number of other techniques and equipment of mutual interest. Write to Recognize Systems, Rad Electronics, 43-22 Queens St., Long Island City 1, N. Y.

*A, normal, but not adjustable except regular employed individual (American with quite serious social and moral stimulation needs)

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AVIATION WEEK and SPACE TECHNOLOGY, May 29, 1962



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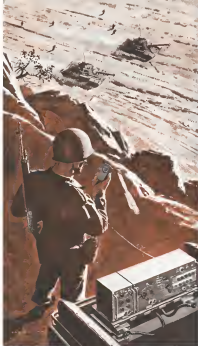
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Assignment from the Army: to develop highly mobile communications equipment for battlefield use, with FM clarity, push-button tuning and accuracy

Action by Avco: the AN/VRC-12 mobile receiver-transmitter—designed, developed and produced by Avco's Electronics and Ordnance Division for the U.S. Army Signal Corps. This communications equipment is now going to Army units and will provide a highly mobile station for use with jeeps, tanks, artillery, command cars and posts.

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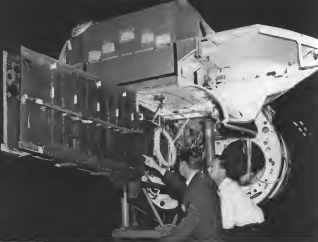
Communications equipment such as this typifies the capabilities of Avco's Electronics and Ordnance Division, suppliers to the armed services and NASA of equipment ranging from large environmental radio transmitters to tiny microvibrators in Explorer XI.

For complete information on Avco's communications capabilities and how they can serve you, write: Division of Marketing, Electronics and Ordnance Division, Avco Corporation, Cincinnati 41, Ohio

AVCO, ELECTRONICS AND ORDNANCE DIVISION, 1000 EAST 12TH STREET, CINCINNATI 41, OHIO
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Avco // **ELECTRONICS AND
ORDNANCE DIVISION**





Forward section of the A2F, showing major portion of titanium center section keel beam

Titanium "backbone" in Grumman A2F-1 gives shear strength at 400F, cuts weight 12%

The 13-foot titanium center keel beam in the Grumman A2F-1 Intruder carries a big share of the fuselage loading. Vicariously the backbone of the aircraft, this keel beam does its job quietly, warmly becoming the two jet engines whose tire pressures reach 400F and higher . . . and even weight doing it.

Stress strength. The fuselage center section of this all-weather, heavy payload aircraft is, as one engineer put it, "all steel." Consequently a deep box beam was needed to carry the heavy concentrations of stress around and provide the required stiffness. Design for stress and buckling at based on those titanium properties: tensile strength, 130,000 psi; elastic modulus, 16 million; density, 0.161 lb/in.³.

Weight savings. Because of its light-weight strength at elevated temperatures, titanium replaced aluminum and stainless steel for a weight saving of about 12%. The need for close strength dictated use of titanium sheet alloy Ti-6Al-3Mo-2V.

High strength titanium sheet alloys are available from Titanium Metals Corporation of America to solve problems of compression and buckling (Ti-6Al-1Mo-1V), track propagation (Ti-6Al-4V) and shock-free elevated temperature properties (Ti-12V-6Cr-3Al). Titanium sheet alloys enable designers to reduce flowing weight of assemblies up to 30% over steel.

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new ideas in vibration/shock/noise control

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Sea Anchor in the Sky Drop an unbraked payload capable of supersonic speeds and it would tumble wildly with deadly consequences to the pilot. Pacific Division provides a "Sea Anchor" for North America's B-70 capsule by the ballistic rotation and extension of stabilization beams into balancing position using a propellant charge. The subsequent jettison of a drogue chute from the extremity of each beam provides the necessary steady-state effect for the main chute to open. Research, trial flights to earth and comes to rest on a safe and stable attitude. This is another example of Pacific Division's specialized skill and experience in propellant-actuated systems. Equally effective systems have been devel-

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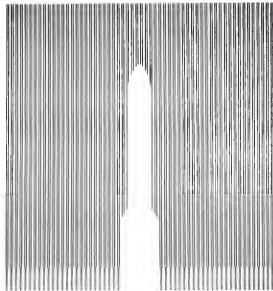
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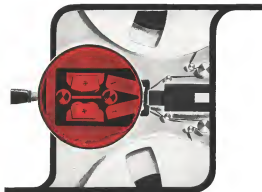
MIL-W-5066, MIL-W-5274 and MIL-W-8777. ■ This integrated production combined with rigid quality controls (one out of every ten Packard employees is an inspector) and Packard experience in supplies to the aircraft industry since before World War I) result in aerospace hookup cable with maximum reliability. ■ For complete information, contact our home office in Warren, Ohio, or either of the Packard Electric branch offices—Detroit or Los Angeles.

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AVIATION WEEK and SPACE TECH

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Mindpower and Manpower... shaping the future in AEROSPACE SYSTEMS



EDITORIAL

The Management Challenge

The aerospace industry has been remarkably slow and unresponsive in seeing the basic changes in its relationship with its largest customers—the U.S. government—during the past few years. The pages of *Airways West & Space Technology* have been filled during these years with both the broad outlines of these trends and the detailed methods by which they were being applied, but the industry, in its behavior, offered little evidence that it was meeting either the printed page or the fine print clauses in the contracts it stubbornly signed during the period.

Now it has come face-to-face with the recognition so well stated by William M. Allen, president of Boeing, that it faces a basic battle for the continued existence of private industry in the defense business against the management and financial overreactions of its principal customers—the government.

It is truly remarkable, in view of the assumed congressional bias, the 20-20 hindsight of the General Accounting Office reports, the Reception Board's equal practices and many other manifestations of these trends in all branches of the government, that it took the Air Force Systems Command—rather than industry, itself—to conceive what resulted in one of the most remarkable conferences in the post-war history of the defense industry, at Monterey, Calif., the first week in May (AW Vol. 14, p. 21).

Impetus From Schriever

The Systems Command management conference at Monterey was organized on the initiative of Gen Bernard A. Schriever, who, since the formal resignation of his command less than a year ago, has been mightily concerned with the growing problems of the government industry management situation in the weapons system development business. This conference attracted an extremely high percentage of the industry's top management and gave them a rare opportunity to sit down across the table from their military counterparts in some remarkably frank and blunt discussion of these problems.

For the first time the industry leaders were able to get a good broad look at how far their government policies have cooled their prime function of management in a system of private industry and how far each of their individual sectors either the momentum glow of winning a major competition has set them all back. At the same time it provided an opportunity for the new breed of military managers, many of whom regard profit as a duty word and an unnecessary cost of operations, to discover some of the grosser problems of private industrial management.

Being's Bill Allen, who has been a cooperator and articulate exception to the many aerospace industry lead-

ers who react with fear or apathy when confronted with these problems, again did the entire industry a tremendous service with his presentation at this conference in which he not only outlined the specific slacks in which private management is being effectively strangled by government, but also effectively explained the needed work of private industry in its military audience, including the essential manufacturing function at profit.

The conference also provided an opportunity for some of the brighter military managers within development managers to get across to some of the more old-fashioned elements of the industry the basic changes in management techniques that the new technologies and stiff international competition impose on both sides of the government-industry partnership.

Effective First Step

No conference ever asked all of the problems it considered and the Monterey session will prove to be no exception. However, unlike many conferences, the machinery has already been established to follow up on many of the major conflict areas in cooperative industry and military participation to produce effective solutions. It also provided, by its blunt interchange, the first beginning of an effective foundation of common understanding of both participants' problems to increase the odds for eventual solution. And Gen Schriever, both in his conference speech and in his post-conference remarks, made it clear that the conference and its resultant forest is only a beginning toward the drastic goal of more effective military-management techniques that are now vital to survival in the current competitive international atmosphere. We sincerely hope that both the industry and military participants in the Monterey conference will understand the full extent of both Gen Schriever's and Bill Allen's message.

We strongly agree with Bill Allen's conclusion when he told the conference:

"I firmly believe that our security requires a strong and effective participation by private industry in our defense effort. Accepting this challenge, industry can and must do better. The means at our disposal to improve our performance are many. They must be attained. Our best will be ours too good."

"On the other hand, if the price benefits obtainable through this enterprise are to be realized the essential ingredients of the system must be recognized and encouraged by our government and the American people."

"In my view the results achieved through our competitive effort and profit system are not sustainable by any other system devised by man."

—Robert Hutz

WHO'S WHERE

In the Front Office

Frank Gert Janssen, vice president planning, Douglas Aircraft Co.'s Aircraft Division, Long Beach, Calif.

George S. Goldstein, executive vice president North American Aviation's Columbus Plant Division, Greenville, S. Carolina. E. F. Wilson, vice president of North American's Space and Information Systems Division and general manager of that division's new Tulsa IC&I facility.

Edith E. O'Brien, a vice president, Lockheed Aircraft Corp. Mr. O'Brien continues as president of Lockheed Aircraft Service Co., Chula Vista, Calif.

George M. Ryan, president, Boeing Lab. Inc., Santa Monica, Calif., succeeding Kenneth S. Bennett, vice president.

Chenfield F. Seibert, president, Tinsley Equipment Corp., Corbridge, N.Y., a subsidiary of Pull Corp., succeeding George A. Peery, who has been named vice president marketing for Pull Corp.

Sam F. Aik, a vice president, The Sylvania Corp. Mr. Aik continues as general manager of Sylvania's Spacecraft Division, Culver City, Calif.

Dr. Chester Bergman, vice president and chief, and Dr. Lee Shafritz, vice president and chief, National Engineering Science Co., Pasadena, Calif.

James B. Gern, president and general manager, Radiochem. Counter Laboratories, Inc., Skokie, Ill., a subsidiary of Allied Research Associates, Inc.

Edmund C. Roscoe, vice president and general manager, M. Lee Smith, Inc., Flushing, N.Y.

Wesley Benson, vice president-administrative systems division, Fairchild Electronics Corp., with offices in Washington, D.C.

C. M. Ball, former vice president of Southern Aircraft Industries, Inc., Douglas Aircraft and Landing Division of General Dynamics, elected vice president-operations of Frontier Airlines.

William G. Chisholm, a divisional vice president and Titan project director, American Machine & Foundry Co.'s Government Products Group, Littleton, Colo.

Walter B. Hines, vice president, Corbin Controls Corp. Mr. Hines continues as general manager of the company's Transducer Division, Pasadena, Calif.

Dr. Clarence Kase, a vice president, Acoustics Associates, Inc., Los Angeles, Calif. Dr. Kase is corporate director of research for Acoustics.

Robert J. Buckley, a vice president, Ball Corp. Louis-Hamilton Corp. Mr. Buckley continues as general manager of the Standard Steel Division, Bensenville, Ill.

N. Heath McDowell, a director and vice president engineering and sales, Mann Inc., Bloomington, Conn.

R. Alan Mills, principal vice president-overseer properties American Airlines Inc. The Trans-Texas Airways has elected the following new officers: R. E. McKaughen, Jr., executive vice president; H. E. Eckman, senior vice president-administrative planning; M. Kase, vice president-tickets and sales; H. R. Pitt, treasurer; Jack K. Ayre, secretary.

(Continued on page 117)

INDUSTRY OBSERVER

First complete G3A space heater (Titer II) vehicle-in a 120-in. solid propellant rocket strapped to a USAF/Martin Titer 2-is scheduled to be fired in January, 1968, in next Flight Qualification Program for USAF/Strategic Command's Space Systems Division (see p. 98).

Data from nuclear tests now being conducted by the U.S. in the Pacific probably will be compared with results of analytical study, begun about one year ago by Rome Air Development Center, on the proposition of electro-magnetic signals from nuclear explosions. Comparison will enable assessment at the validity of the theoretical approach.

Watch for possible use of aerial helicopter in Vietnam by U.S. Army as effort to use low-altitude "army" helicopters in tests to test and conducting small portable launchers. U.S. Army has approved Special Warfare Aviation Development at Ft. Rucker Special Warfare Center. Four Sikorski H-19s and four Bell H-19s comprise the unit, former six armed with 45 277-in. sub-rocketed rockets and the latter two, four 30-in. machine guns. Army Medical Air Evacuation Unit using Bell HU-19s has recently joined helicopter support forces in Vietnam.

Two-week intensive evaluation of two McDonnell F-4H aircraft has just been completed by Tactical Air Command at Nellis AFB, Nev. One difficulty noted was wheel axle assembly in two hours a budget for TAC needs. Changing wheel axle could result in major changes to the aircraft.

Techniques for disabling sensors should handle satellites or space vehicles would be studied in a program near radar considerations at Air Force Systems Command's Space Systems Division. Program, code-named Black Eye, covers possible use of high intensity, high energy beams of radiation, such as those generated by optical lasers, to be focused on moving parts of spacecraft vehicles to knock out vulnerable sensors or infrared detectors.

Concern over high interest in the Ringdown concept among launchers of aircraft is increasing among NASA personnel connected with development of the device for space payload retrieval. They feel launchers may be developed by the apparent simplicity of the flexible wing, and get into serious trouble if they pursue projects along it.

Nutrient threat of United Technology Corp.'s 128-in. sub-rocketed rocket for Titan 3 applications may delay the design of the rocket's 100-in. motor throat which will cost \$7,000 per inch, temperature in a new design. Living with 16 non-aerodynamic girdle segments in a random arrangement at the throat.

New/Bosch K202-E rocket-powered, reportedly reliable target is being considered for delivery of small nuclear weapons. Slight modification should give it nuclear-delivery capability at speeds of Mach 3 at altitudes up to 90,000 ft.

Rolls-Royce RB 162 prototype 1st engine has reached 4,400 lb. thrust during test stand running. Engine started tests last November, is noted as a thrust output of 6,000 lb. for production engines.

Nuclear cell techniques for locating and potentially hostile radio-communicating satellites now are being studied by Space Radar Corp. for Air Force Special Weapons Center.

Industry proposals for an advanced gliding solar observatory are due at NASA's Goddard Space Flight Center late this month. Vehicle will have a more complicated attitude control system than the low GSD to enable it to point, on command, at specific points in the sun.

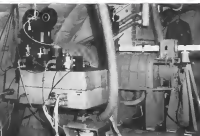
Reports for proposals for USAF/Naval/Military/Maritime ground detection system have been issued to 28 prospective bidders in competition sponsored by USAF Systems Command's Ballistic Systems Division. Maritime ground system will provide data processing, communications equipment and system support required to monitor, control and launch the missile.

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The new all-weather SEASPRITE can "home in" automatically on any distressed pilot and crew equipped with a UHF transmitter. Moreover the SEASPRITE can operate off any ship of the fleet as small as a destroyer. The navigational and direction finding equipment aboard the SEASPRITE gives it an effective search and rescue radius of 200 miles. Its IFR instrumentations lets it fly anytime. This is an all-weather helicopter for an all-weather Navy.

THE KAMAN AIRCRAFT CORP., BLOOMFIELD, CONN.





SKYSOARER, an airborne synthetic aperture radar in the infrared, visible and infrared radiation emitted by a re-entry vehicle missile, passes its first functional test flight. The Bendix Systems Division is developing the system for Air Force Cambridge Research Laboratories under sponsorship of AFRL. Insert shows [a] infrared optical instrumentation behind glassed "eye" port forward of wing and CR control, monitoring and recording equipment at the operator's console.



AIRBORNE INSTRUMENTATION, a key to development of advanced defense systems, is a major field of activity at Bendix Systems Division. Opportunities are open for experienced engineers in optical and microwave instrumentation, re-entry physics, data handling systems, aircraft installation, or flight test. Write or call our Personnel Director, Bendix Systems Division, Ann Arbor, Michigan—an equal opportunity employer.

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THE FUTURE**

Washington Roundup

AF Space Aims Jolted

Air Force space ambitions are being jolted by the House Science and Astronautics Committee. Far down in its NASA budget bill (see p. 15), the committee and the space agency have now set an air force production over the land of space. The language was inserted after the committee visited Cape Canaveral to investigate friction between the Air Force and NASA in operating the Atlantic Missile Range.

Air Force leaders were stunned by the language and are now expressing their fear to lawmakers on Capitol Hill. Air Force fears the committee's language will restrict its authority as manager of AMR by giving NASA jurisdiction over all of Cape Canaveral. Air Force leaders see the language also as a threat to the service's long-term space ambitions.

Another jolt to the Air Force is in the works. The House space subcommittee staff has written a report recommending that the service assign space affairs to its own field office as an office of NASA, much like the military applications branch of its Atomic Energy Commission. Under this proposal, the Air Force would relinquish such named space projects as Diversion and the N-15 to the nonnamed space agency. The staff report is expected to be released soon, but has not been adopted by the committee.

Soviet Tracking Station

Russia has broadened its search for foreign satellite tracking stations to include Australia. The Australian government has declined to comment on the Soviet request, but will likely do so soon. Soviet technicians, in an earlier search in Indonesia, conceived proposed sites for a tracking and communication station on the island of Ambon and Sumatra in the Banda Sea (AW May 3, p. 17).

Dr. Jovani A. Van Allen, director of the Van Allen radiation belt, stated a House appropriations subcommittee is closed season by declaring "the common statement that the Russians do not tell us the results of our satellites is not always wrong." He and U.S. officials had received much valuable scientific information from Russia, especially on the lunar flight.

Watch for NASA to start having some of its complex computer offices than continue moving them. Top agency officials, after a detailed study, have concluded this is the less expensive approach in many cases.

Defense-Industry Liaison

Deputy Secretary of Defense Russell Galtman is trying to form an all-defense advisory council to coordinate relationships with defense allies, thus contributing to tech. and developing and fine-tuning with several organizations. Such a council would provide a single, standing board for industry views, give contractors a clearing house and provide a mechanism for existing Defense-Industry task forces. Galtman already has discussed the proposal with several groups, including Aerospace Industries Assn., Automobile Manufacturers Assn., Electronic Industries Assn., National Assn. of Manufacturers, National Science Industrial Assn. and U. S. Chamber of Commerce.

Liquidated Management Inc., now working up its report on Defense procurement of aerospace-type goods is also studying the board problem as existing aerospace contracts. LMI's aerospace contract report is due at the end of the year. Another LMI study under way is designed to find ways to reduce unnecessary specifications in Defense contracts.

Riddle Seeks Argosies

Riddle Airline, largest Military Air Transport Service contractor in fiscal 1962, has sold its seven Argosy Aerobus Whitworth 180 turboprop Douglas Truck to Whitworth-Glaser, financial agent for the British manufacturer. Regardless of whether Whitworth-Glaser finds a U. S. buyer, the \$10.9 million in principal and \$100,000 in interest Riddle owes on the contract will be considered paid June 30 because of the return of the Argosies. Whitworth-Glaser is anxious to keep the Argosies in the U. S. and said it has "completed negotiations" for a sale to Capital Aircraft.

Chairman John McClellan of the Senate Permanent Investigations Subcommittee and Donald Douglas, Jr., president of Douglas Aircraft Co., but at odds over what should be considered "profit." Sen. McClellan charged last week that it was "gross delinquency" for Douglas to reduce its Nike program profits by \$25 million spent to develop the DC-8. He demands profits, regardless of whether they are subsequently spent on other company projects, should be considered profits—not costs.

The Rev. Francis J. Heydys, S. J., head of the non-profit group planning a ghettoization for Washington, possibly and the ghettoization will be short a fact and a half larger in character than the one in Moscow—said statistics will be closed.

—Washington Staff

120-in. Solid Cluster to Be Studied for C-1

By Irving Stone

Los Angeles—Potential of a two-stage solid and a three-stage gas-propellant Saturn C-1 launch vehicle using a cluster of 120 in. solid subpropellant motors for the first stage will be evaluated in a seven-month, \$1,000,000 study sponsored by National Aeronautics and Space Administration's Marshall Space Flight Center.

The study specifically will be aimed at determining if substantial gain can be realized in Saturn C-1 performance, cost reduction and reliability by employing the presently planned first stage consisting of eight 185,000 lb thrust Rocketdyne H-1 LDCX/RF motors with a 120-in. solid motor cluster, providing that current requirements for 1968 and beyond justify such a change.

Proposals in the industry competition for the study are due May 18, only five weeks after requests for proposals were issued (Apr. 16). Companies proposing, which probably will include Lockheed Martin and Space Co., Douglas, Space Technology Laboratories, Boeing, North American Aviation, Space and Defense Systems Division and United Aircraft Corp., will have to obtain preliminary data on the 120-in. motor from United Technology Corp., whose selection as contractor for the booster studies for Air Force Systems Command's Space Systems Division Titan 3 vehicle was announced May 9 by Department of Defense (AW May 14, p. 35).

Solid Vehicle System

The Saturn C-1 using the 120-in. solid propellant cluster is being studied by Marshall Space Flight Center as the C-1 solid vehicle system, although it will have liquid-propellant upper stages. Second stage of this configuration would be a single LDCX/RF motor, a 300,000 lb thrust Rocketdyne J2 engine designated the 848 stage, built by Douglas Aircraft. Third stage would be two H-1 engines, LDCX/RF thrust 185,000 lb. Whiting 8L11A-5 motors. Funding for the development of this C-1 solid configuration is planned to begin in Fiscal 1965, and the first launch of the vehicle is planned for mid 1965 or early 1966.

Missions to be assumed in the study of the Saturn C-1 solid vehicle are the following:

- **Breakdown missions** at 190- to 109-sat-mph altitude, using the two-stage vehicle.
- **High-altitude orbits** ranging from 190 to 19,000 sat-mph on (stationary thrust), using the three-stage solid vehicle.
- **Launch stage delivery**, designated by Marshall Space Flight Center as a "two-

stage vehicle mission," using the three-stage vehicle.

• **Planetary flights** to Mars and Venus (Mars) to Saturn, using the three-stage configuration.

The study is expected to produce results in three broad categories: trajectory and performance analysis, propulsion design and criteria, and structural analysis.

Optimum trajectory and performance will have to be detailed for each of the orbital and cruise missions planned, as well as performance requirements for each stage of the vehicle.

A detailed preliminary design of the subpropellant first stage will be required, with specific emphasis on motor clustering design requirements, design of interstage and interstage structure, thrust vector control component design, vehicle dynamics, separation dynamics and acceleration loading.

Contractor Cooperation

Acquisition of this information by the study contractor will require close cooperation, probably on a subcontract basis, with United Technology, developer of the 120-in. solid motor. It also will require coordination with Air Force Systems Command's Space Systems Division, which has acquisition of the motor development for the Titan 3 program.

For the companies proposing in the competition, the date for submission of proposals (May 18) comes at an awkward time, since United Technology will now be negotiating its contract for the development of the 120-in. motor and is deep in its own preparation for the development program, which has a relatively busy schedule.

Probably a cluster of not more than two 120-in. motors could be used in the Saturn C-1 solid vehicle because the total impulse delivered by these two motors would match fairly well the total impulse delivered by the eight Rocketdyne H-1 engines each of which has a thrust of about 185,000 lb. A cluster of three 120-in. motors would develop too much thrust to be compatible with the upper stage structure of the Saturn C-1.

There will have to be some modification of the 120-in. motor to match the structural limitations and dynamic characteristics of the staging operation.

Length of the 120-in. solid, four-segment (last center segment plus end cap) motor from nozzle exit plane to tip of the tip and cap will be about 37.5 ft. Corresponding length of a four-segment motor will be approximately 67 ft. That of the four-segment motor will be approximately 100,000 lb.

First-segment configuration would produce about 1,000,000 lb of thrust.

Probably a different degree of thrust vector control will be required for the 120-in. solid motor in the Saturn application than would be used in the Titan 3 application, for which the motor reportedly has been designed, because of the difference in maneuvering of the two vehicles.

Ignition for the 120-in. solid motor will be accomplished with a conventional spark because of the conservative approach required in this initial research application of very large subpropellant motors, although United Technology's last firing of a 109-in. motor was ignited with chlorine trifluoride, which provided bipropellant reaction with the propellant.

Another feature of the study will be to determine the refueling necessary to make the Douglas 848 second stage compatible with the first and third stages and, if required, to provide a change in propellant loading for increased vehicle performance. This requirement will involve sufficient details to provide a reasonable basis for estimating weight and assessing development tasks.

An estimate will be required of the staging necessary to make the Cape Canaveral launch facilities (Complexes 54 and 37) compatible with the Saturn C-1 solid vehicle, which is planned to be launched from the Atlantic Missile Range.

Operational Analysis

The operational analysis will require an overall evaluation of the vehicle for its estimated of the vehicle, initial and inherent reliability, reliability growth with time or mission, and total vehicle reliability through completion or second or third stage separation, depending on vehicle configuration.

A plan also will be required outlining schedules and final post-funding, for developing the first stage and modifying and joining the second 54 and 37 stage and defining operational operations per flight vehicle broken down in accordance with test schedule and flight schedules which will be furnished by Marshall Space Flight Center.

A complete operational plan will be required for the C-1 solid vehicle, providing manufacturing plans, transportation modes, stage assembly modes, checkout procedures, launch plans, and on-orbit test requirements, Marshall stated.

The study contract will be given a DOD-2 (basic contract) priority rating, which is just below the highest (DIX) priority category under National Defense Certifications.



Murray Pilot, Navy Lt. Col. M. Scott Carpenter checks installation of wiring and cables on the main pressure bulkhead of his Air Force 7 capsule at Cape Canaveral, Fla. (left). Handwoven material, which applied over the outer insulation, serves as a spacer and heat barrier between the bulkhead and the heat shield. Working on the capsule's nose (right), Carpenter holds his survival kit which includes his air tank, food, first aid equipment, medical kit, portable radio, signal collector and shock repellent. Several manometers on Carpenter's left forearm are used to read blood pressure gauges. Carpenter's MA-7 flight was scheduled for the latter part of last week.

Carpenter Prepares for Scheduled MA-7 Flight



Carpenter makes an open test from the escape hatch (left) in the reinforced nose of the spacecraft. Part of nose wings on top of neck in capsule neck is the UHF antenna and recovery antenna in dorsal position. Tube (center) in front of the pilot's face holds the antenna which positions the antenna (right) and drops chute just prior to nose chute deployment. At right, Carpenter checks the Murray flight equipment around while being in his capsule during a training exercise at the National Aeronautics and Space Administration's Range 5 at Cape Canaveral. Chute motor reflects instrument panel window to a movie camera mounted above it so that pilot could experience what he would see in the flight path. Murray on back of Carpenter's right with silver pilot to check equipment behind him in capsule without turning around.

Soviet Scientists Disagree With Titov on Extent of Space Sickness

By William S. Reed

Los Angeles—Extent of Cosmonaut Titov's sickness during his sixth orbit has become a matter of disagreement between the cosmonaut and the Soviet medical scientists who followed his flight.

Three Russian research physicians who visited the University of California at Los Angeles Medical Center revealed that a smaller number of effects, especially dizziness, on the space orbit on which Titov was studying. The Russian doctors were quoted by U.S. press agencies at a reception given at UCLA after they had observed the Cosmonaut on Space Research (Cospar) meeting in Washington (AW May 7, p. 15).

Dr. V. V. Pavlov (see Paris Cosmonauts Special report, p. 78), and several other biomedical scientists at the National Academy of Sciences, Moscow, said that Titov began to have symptoms of dizziness, nausea and vertigo beginning at the sixth orbit. These symptoms became worse during the seventh orbit and were somewhat eased on the seventh. Titov noted his head pain while he attempted to do work outside while cosmonaut John Glenn's rapid ascent. Titov slept on the capsule orbit and continued sleeping for a little over eight hours. Then reported that Titov felt somewhat better after the day.

The Soviet doctors reported that the sleeping dogs on earlier space or experiments demonstrated instability of the audio-visual system—changes in blood pressure, pulse and electrocardiograph traces—plus confusion of the control surface control system. Titov's admission could be further described.

Titov reported his sickness at the Cospar meeting, but the Soviet doctors were more reserved, indicating that even in Soviet Union, test pilots and doctors sometimes disagree sharply.

Neither the U.S. nor Soviet physicians were able to explain why the Russian cosmonaut, and the dogs which preceded him in 24th orbit, because of the same number of orbits. One theory is that fatigue could have contributed to the condition. On the end of the fifth orbit, both the dogs and Titov had been aloft more than 7½ hr, and had undoubtedly been awake and under the most severe nervous strain for possibly 30 hr since prior to launch. There is, however, no data to support the fatigue theory. The use of dogs or hypnosis on the cosmonauts was denied.

Dr. Peter presented Agasson as Yasi

Gagarin's pulse and respiration which compared favorably with the figures taken on John Glenn. At T-15 hrs, pulse was 66 and respiration was 14 breaths per min. At T-16 hrs, Gagarin's pulse went up to 109 and at T-17, pulse was 130-135 and respiration was 18-20. At T-20 the end of the first orbit, pulse was 100, respiration 15.

Blood pressure measurements were made on the dogs as well as on the two cosmonauts, the doctor said. Perforations into the skin of the dogs was made for the purpose of taking blood pressure measurements but Dr. Peter neither confirmed nor denied that Gagarin or Titov underwent any such device, although blood pressure measurements were made. Glenn carried a recently developed electronic device taped to the skin surface for blood pressure measurements (AW May 5, p. 20).

Asked why Gagarin did not come to the U.S. instead of on work Titov, one of the doctors stated in Gagarin's language, because somewhat displaced with Glenn officials during his visit and is feared that he would be well-dressed politically at Titov.

Another of the Russian doctors, A. A. Isakovskiy, director of the Institute of Microbiology in Moscow, said that it would probably not be possible to completely structure brain and placental probes and some contamination probably would result. Long-term tests have been found to remove various microscopic particles of dust even after being subjected to new vacuum conditions and heavy radiation.

Lockheed Test-Fires 120-in. Solid Motor

Beltsville, Md.—Large solid fuel rocket motor to be fired in the U.S., a 120-in.-dia. motor, was tested by Lockheed Propulsion Co. at the Patuxent test facility on May 13.

Contract 172-120-1000 for the polybutadiene HTP propellant, the motor developed 464,000 lb of thrust. Total weight of the loaded motor was 130,000 lb. During the 120 sec. run of the large solid fueled motor, repeated tests of thrust vector control by liquid secondary injection were made using nitrogen tetroxide. Lockheed officials at the site termed the test completely successful in every respect. The test began with the development under Air Force contract which saw the hardware fired 18 months after it left the drawing board.

Qualitative, the effectiveness at liquid secondary injection for thrust vec-



LOCKHEED PROPELLION CO. test-fires a 120-in. dia. solid propellant rocket motor.

tor control could be assessed from the observation post located 4,100 ft from the motor test stand. Not only was there a noticeable change in the noise level of the motor exhaust at varying degrees of thrust vector control were applied but a distinct change in the motor flame was apparent. Depending on the amount of nitrogen tetroxide pumped into the motor, a dark burnt orange colored streak of varying length caused the accelerated flame of the exhaust. The motor was fired in its vertical vertical position. Observers estimated that the flame extended 1,710 ft into the air which, similar from the exhaust, reached a height of 5,500 ft. Average temperature in the motor motor nose (SRV) and the maximum temperature recorded was 6,300°.

Given for the 120-in. dia. solid rocket motor (Lockheed designation) was sent by Lockheed Propulsion Co., formerly, Grand Central Rocket Co., in their market system. Principal suppliers of the propellant were polybutadiene, aluminum powder and ammonium perchlorate. Cost of the grain was estimated and the three sections joined together by a tapered pin secured which kept the thickness of the section as thin, except during burning. Center segment weighed 55,000 lb., the remaining 44,000 lb. of propellant divided between the top and nozzle sections.

Lockheed Propulsion Co.'s Patuxent test stand is situated for rocket motor of up to 2 million lb thrust mounted in either a horizontal or an inverted vertical position. A Lockheed engineer said that only a very small volume of data results from firing in an inverted rather than an upright position.



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Steady Traffic Surge Raises Airline Hopes

Latest figures indicate business rise is continuing; carriers optimistic that two-year slump is ending.

By L. L. Doty

Washington—Sharp upsurge in U.S. scheduled airline passenger travel during the past five weeks is giving the industry renewed hope that the recent lull from traffic depression is properly a more than a temporary adjustment.

This optimism is based on the fact that business has been increasing for the past five months, after nearly two years of traffic depression. The bright prospects have convinced a number of local service operators that their industry is experiencing the start of a long-range growth period that will generate a revenue passenger mile increase this year as high as 25% over the 1961 total.

Estimates for the truck carrier in excess this year ranged as high as 16%, but more conservative forecasts put the figure at 12%. Local service carriers are expecting a moderate increase that should closely correspond with the hike in passenger volume, but the confidence, because of the continuing switch from first-class to coach travel, feel that gross revenue will not rise much more than 9%. Local service carriers are also concerned by a steady climb in fuel cost, an expenditure that has cooled the outlook for the year. In April, eight of the 11 local service airlines reported sufficiently large increases in individual fuel costs to raise the overall fuel factor of the local service group from 0.23 to 0.43-0.45.

Local revenue for the truck carrier in April dropped 4.9% to \$4.15, with last

one of the 11 airlines able to report an increase.

For local factors, however, as far as forecasting, as they may appear. Besides, they affect the continuing expansion of available seat miles brought about by the high net capacity of each jet transport, not necessarily by increased fleets of jets. There has been no word of curtailing this expansion since the number of jet aircraft now operating in scheduled service is twice sufficient to maintain adequate service.

As a result, the truck carrier has been forced to operate a splintered number of cargo units on traffic growth is retained in the rate on which the production of jet aircraft not promoted. If traffic growth is continued, as a new product, then this local factor problem will correct itself and reach

problems is excessive competition and declining aircraft utilization rates may help more.

At the moment, however, low load factors represent a problem for the truckline. Only one carrier—Delta—maintained a load factor above 40% in April and as three airlines—Continental, Northwest and Northwest—lost factors for April dropped below 30%.

Coach load factor, which normally holds well above 60%, was dropped to 57.5% in April for the 11 airlines while the first-class load factor fell to 40.7% to 42.5%. With coach-passenger disposition and coachline revenues dropping, the truckline's overall load factor appears to be drawing itself to the brink of a point.

On a long-range basis, two bright spots are becoming apparent. The steady drop in load factor since the start began in 1960 (AWJ July 15, 1960 p. 39) will probably reach its peak this year, and the spectacular upswing in first-class travel began in April and continued on through the first weeks of May gives a promise of a healthy recovery for the industry.

It is now generally believed that the swing from first-class to coach will result in a virtual halt to coach coach traffic volume reaches 65% of all traffic. In April, coach service accounted for 63.5% of total revenue passenger miles compared to 51% in April, 1961. For the first four months of 1962, coach revenue accounted for 63.5% of total traffic.

April climbed 51% over the previous April, while first-class revenue passenger miles declined 10.9%. Increase in available available seat miles was only 1.1%, but coach available seat miles jumped by about 40%.

These figures would appear to indicate that the move from first-class to coach is gaining momentum, while the first-class traffic is being reduced. Comments feel that the drop in first-class traffic is slowing and that the moderate first-class increase will show a significant about 15% of the total market. This optimism, though, is based on better past experience in this area and a limited amount of research.

It has been suggested that if the industry stopped complaining, the switch from first-class to coach would be a switch from labor, from industrial and business customers would be persuaded to order their employees and officials to travel coach. The fact that large business corporations had used such sales

personally after jet travel emphasized the slight difference in first-class and coach services, is a renewed view of the chief reasons that first-class sections lost so many customers to coach.

Local service airlines, which—with rare exceptions—offer only one standard of service, reported a 21.5% rise in revenue passenger miles in April, with only one airline—Frontier—failing to show an improvement. Central, Mainline and Braniff reported the largest gains. Each of the truck carrier reported a decline in first-class revenue passenger miles in April, and all but Northwest showed an increase in coach traffic. Northwest was the only trunk to show a total revenue passenger mile decline. East Coast operation, failed to do so. American's President C. B. Smith also expressed optimism for the National.

Western Airlines was the only trunk to show a decline because a part in the one.

In several strong exchanges between Delta's success and the two companies preparing to merge, Delta was viewed as the "strong" airline. Southern and Delta was in a "very unique and happy" situation with no competition as much as at Atlanta, Los Angeles, Miami, Dallas and Chicago-New Orleans.

He said that Delta was the "most sheltered carrier," with more good network routes. "South has some two best but many in Delta," Smith said. Most of the problem was confined to operating and financial details of American and Eastern, with little discussion of the past and some of the proposed merger. He added that the Maritime Line's president, and that there had been very little planning of operation in the event the merger was accomplished because "we have been more preoccupied with getting ready for the case of such raising as we are airline as best we can."

Smith said there should be more in the merger, but when asked what specific changes he had in mind, he replied that "it would be a presumption on the part to suggest to the small carriers how they should run their business." He said he had operations on which carriers should be changed, but that he did not care to express them.

The operations lines which the truckline industry may be starting to carry on be classified in 1961. He said the current 1960-April period was the worst period since the 1950-1960 period in which the industry was not representative.

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American-Eastern Merger Draws Mild Opposition From Carriers

Washington—Civil Aeronautics Board members in the American-Eastern Merger Case, which began May 10, continued through last week with indications that the proposed merger will meet with less carrier opposition than originally expected.

Del's Delta Air Lines brought first into the possibly elite proceedings National Airlines representatives, who were expected to counter-argue Eastern's case. The National's President, East Coast operation, failed to do so. American's President C. B. Smith also expressed optimism for the National.

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costs and lower revenues will reduce the proposed plan's success.

McIntyre noted that it has been impossible to inspectable to arrange financing for the 46 Boeing 720-200 jets, the airline would have another 46 jets, but he added that he had not tried to undertake any refinancing program for this reason, but noted that if the airline is in the black at the end of the year, it may then be ready to seek refinancing.

In discussing other possible merger partners, McIntyre said that before the American-Eastern merger was dealt with, Eastern had considered Northwest, but felt that it was not large enough to "give us the second rung of player" needed to provide efficient operation of the merger.

He said that he had discussed with National the importance of Pan American's status of National could but could not really talking to Pan Am on the subject. McIntyre said that he had discussed with National the importance of Pan American's status of National could but could not really talking to Pan Am on the subject.

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Sayen Letter Viewed as Re-election Move

Washington—Renewal of the Air Line Pilot Association's presidential and policies for future progress has been suggested by member President Charles L. Sayen in a letter which many members feel indicates he will run for re-election at the union's forthcoming convention in Miami on May 29.

Sayen told the union last year that he would resign after 1964, his personal opinion, but he denied rumors of progress made during his presidency, and his re-elected grand order for ALPA officials, he has received many union members that he would accept a dual nomination for re-election, despite his personal denial.

There was last year's union suggestion, outlined in a letter to the union's board of directors.

ALPA's presidency must be a full-time career job, with at least a 4-year term. Current conditions for the position require retaining that union security clause.

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Tightened Control Points to SAS Recovery

By Carl Rowland

Stockholm—Carl Nicolin, 41-year-old Swedish industrialist who assumed the post-war of Scandinavian Airlines System on an interim basis about 10 months ago with the assigned task of helping the airline's sagging economic fortunes, now believes SAS should be able to reach the breakeven point during the course of its 1982-83 fiscal year ending Sept. 30, 1983, at present trends hold.

After assuming substantial financial losses over the two fiscal years prior to Nicolin's arrival, SAS has been steered through an accelerated downsizing and re-organizing process ranging in scope from a management overhaul to a new approach toward personnel as a whole, with increased output the major theme.

Emphasis has been on strict cost control, efficient utilization of available aircraft and personnel, with a major personnel restructuring at the latter, and a general shifting of management responsibility so that the areas of profit or loss can be clearly pinpointed, defined and, if necessary, isolated.

When Nicolin took over the reins of SAS last summer, the airline, admittedly suffering from the jet pricing pains of that turbulent period, had sustained a \$16.8 million loss in the fiscal year ending Sept. 30, 1980, and was well on the way toward a \$17.56 million loss for the then current fiscal year, with few upward prospects of any immediate change for the better.

This year also will go on the debit side of the ledger, although Nicolin says the loss should only be a "fraction of that of last year." By the end of the next fiscal year, when his resignation is expected, he hopes, even all hard factors may be on the record, Nicolin believes the airline will be well along the road to recovery.

With this prospect in view, he recently stepped aside to return to his previous post as a managing director of ASSEA, a major electronics manufacturer and a holder of Swedish industry with about 15,000 employees, a position he had assumed only two months before leaving the SAS oil for help.

By the time available, he has already successfully had planned to return to ASSEA on Jan. 1 but sustained another four months to see his responsibilities through—Nicolin agrees that only the "tenth demand" could be easily waived. These have been categorized on occasion within SAS and elsewhere, giving him the nickname in some quarters of "Nick the Kwik," but they appear to be achieving the desired results.

Nicolin's moves in SAS have included:

- General management overhaul, including the policy machinery in Stockholm while placing day-to-day control of operating ability, scheduling, fuel and loss, with the major indigenous divisions, Sweden, Denmark, Norway, and to a large degree, Scandinavian Airlines System, Inc., in the U.S. (AW Feb 26, p. 47).
- Sale, direct or separation into separate subsidiary agencies of previously inseparable divisions. New subsidiaries have one mandate for survival: show a profit.
- Increased aircraft utilization and, as a major byproduct, get larger recognition with other airlines over current route requirements where current equipment had been used haphazardly. Scheduled operations now for SAS Douglas DC-6 transatlantic transports in the summer of 1981, as an example, stood at 9.75 per day, with an actual rate of slightly over 10.4 per day. Planned reduction for the month during the 1982 summer schedule is 12.14 per day.
- Cut in employment figures during Nicolin's term is a total of approximately 2,500 persons to the present fleet of 11,000-12,000 flight personnel, 10,725 ground employees. Of those dropped, about 260 left on direct company initiative. The remainder simply were not replaced after they had fallen out as part of the normal turnover cycle.
- Focus in individual output that has seen them overcome the decline in air employment. With an 15% reduction in personnel, Nicolin attributes on the basis of available figures that total production during the summer schedule will increase by more than 15% (Nicolin down, this is a production pay-off per

employee of some 40%." This does not mean that all employees are working harder," Nicolin says, "... they are working more efficiently."

• Corresponding cut in overhead by "eliminating the (non-technical) work not necessary to be done." While there are no specific figures available in these reductions, overhead reportedly has dropped by 40% in some areas over the past year. Citing one example, Nicolin points to a considerable decline in paper work, a byproduct of the restructuring efforts. In effect, he says, "If you want to use the term, this is 'Prudent's Law' in reverse."

• Reduction in necessary spare inventory, largely as a result of the increased capacity of production and subsequent yield. Again there are no specific figures, but Nicolin says the "spare" (in inventory) has at least been changed to a "downside" trend. He anticipates a perfect percentage decline per aircraft in the future.

• General tightening of cost control procedures, methods and accountability, imply a sufficient of the items but extending to almost every pocket of the company as well.

Resultant Cost Reductions

These measures plus others on a quarterly scale resulted in reductions for the first half of the present fiscal year of about \$6 million below costs for the responsible period of the past year, while revenues increased at about the same level, \$54.7 million. Despite that, losses for the period still will be substantial, according to Nicolin, partially because of SAS's traditional sharp drop in traffic during the winter months. A decline that is markedly greater than that experienced by most other major international airlines.

A number of decisions, "tough" and "unhappy," and reasons to be made, and Nicolin concedes that "such needs to be done in all firms. . . I would not be surprised, if my successor has to face some tough problems."

His successor is a hard-picked one, 55-year-old Erik Nilsson, and there also is informed speculation here that Nicolin will be named to the SAS board while he has continued to monitor progress of his recovery.

Nilsson, with no previous airline experience, was executive vice president of ASSEA prior to joining SAS late last month and served as operating controller at the electronics firm during Nicolin's absence with the title of deputy president.

One of the leading Nilsson staff executives has in the area of overall



CARL NICOLIN

entire whose governments also own substantial blocs of stock and have given the airline financial aid during its period of economic crisis, SAS has been forced in one measure of national cooperation to distribute its revenues and engine overhaul facilities among the capital cities—Stockholm, Copenhagen and Oslo. Such an arrangement seems clearly unsuccessful (AW May 25, 1981, p. 34), but a substitute plan satisfactory to the governments concerned has yet to be found.

While avoiding an outright or indirect control of the governmental problem, Nicolais will see only that "this is an area where something could be done. I don't know what the solution will be."

A study of the problem, which hopefully will produce an acceptable and workable solution, is now under way.

Nicolais' achievement in pushing through his management reorganization could turn out as a headstart. Looking at it does with some of the time-honored concepts. The idea, or model, came having an executive policy-making headquarters in each capital but been reached, and the program as such is part and parcel of what Nicolais considers his most important achievement—the creation of a number of profit centers whose mutual contribution by the airline as a whole can be accurately tabulated.

Control Headquarters

To implement his plan, Nicolais established a functioning control management headquarters in Stockholm through the creation of four new executive vice presidencies and the dissolution of four offices which were largely regional in nature. New posts are technical, operations, marketing and finance.

Heads of the national regions, formerly countries, vice presidents, have stepped down a notch and the corporate line direct to the position of vice president, subsequently to a major degree their regional policy responsibilities but retaining, in return, greater day-to-day operational autonomy. Each region will keep its own books with its own reporting profit and loss sheets.

In the past, Nicolais explained, "the region haven't had a separate profit and loss or balance sheet, and it was difficult to obtain an accurate picture. Now our operations have become more decentralized, whereas policy making is more centralized." This activity was the effect of the reorganization.

"You give a direct cost control, and in any big organization you need a setup that separates people to perform. We should give them the responsibility even between the three regions."

He also has extended the profit center — and profit motive — fleet throughout much of the company,



KARL NICOLAIS

shipping off these activities which he felt were beyond reorganization. As an example of the latter, the money keeping operations have been sold and are now run by a professional outside firm on a strict arm's-length basis.

The profit theme has been applied, among other places, to SAS's \$14-million jet engine overhaul facility at Luleå, Sweden near Stockholm, which is now a separate division with the balance sheet to show financial success or failure. Capable of handling consistently more work than it now has on hand, Luleå is now directly contracted to overhaul the Rolls-Royce Avon engines on Panavia's Sud Caravelle jet transports. It is actively seeking similar outside projects.

In parallel fashion, the airline's catering service has been established as a separate company expected to stand or fall on its own performance. SAS, one, and two, have from other sources, and its delivery, in turn, is selling to other airlines and to restaurants in its efforts to show the needed profit.

The idea organization also has been translated in another policy move, just recently in the Far East where The Atlantic International has sales over to the SAS group in a number of areas. SAS holds 50% of The Atlantic's stock, and its eventual anticipated breakthrough into the black by this carrier could help bolster the parent firm's financial standing.

To help achieve this—and to secure additional inter-SAS revenue—signed a lease-purchase agreement whereby TAI will share in the operation of the Scandinavian center's two Conquest 990 mid-range jet transports (AW Apr. 18, p. 46). Under present plans, SAS will operate the 990s over its southern route to the Far East on a twice-a-week service. Once there, the aircraft will be operated by TAI over its major routes

arguments and then returned to SAS in time to meet the return schedule to Europe.

The long-delayed arrival of the 990s will make it possible for SAS to take its DC-3s off the western route, although they still will be operated over the Falt to the Far East, in time to meet the accelerated summer schedule over the North Atlantic.

Underlying the TAI position, Nicolais sees "it was necessary to get competitive equipment on some of their routes. Everyone else was flying jets, so they began to consider using DC-3s." Of the three DC-3s TAI now has on lease from SAS for use over its international routes, one will be returned and, hopefully, sold.

By hastening the retirement rates of its jet fleet, SAS managed to meet its major commitments over the past year on an equal basis on most of its routes for the first time, even with the delay in delivery of the two 990s, which are just coming in. This was accomplished without any reduction in long-hauling except for the elimination of one flight on once-a-week service between Copenhagen and Stockholm. The two new DC-3s were placed on the South Atlantic route as a replacement for piston equipment.

Control Usage

SAS's Control fleet this summer will range \$9 by a day as opposed to 6.6 in last year with a loading 9.77 in the early-summer 1980, including TAI's planned deliveries. Utilization rates of the airline's piston-engine fleet will decline accordingly, the Conquest 440s from 6.57 to last year to 5.87 per DC-3/TAI's from 5.6 to 5.09. All international routes outside Scandinavia have been assigned solely to jets for the first time.

Introduction of the 990s plus increased utilization will provide SAS with an estimated additional 15% in traffic capacity this summer, but Nicolais foresees little, if any, increase in overall load factors, assuming that the production losses will provide additional passengers but, ironically, not enough to offset the added capacity. Company forecasts indicate a substantial load factor saving in the summer of 1983. Summer load factors for 1981, which Nicolais expects 1982 to meet or to follow, were 52% on a company-wide basis.

Nicolais also departs from the traditional SAS position of preserving lower fares as an initial step toward attracting more passengers and, eventually, greater profits. He says:

"My philosophy is that best results can be achieved by starting out on lower fares and then, if possible, lowering fares instead of vice-versa which has been the custom in the past."



Side view of model of proposed 25-passenger Heinkel HE 211B-1 short-range jet transport (AW Apr. 10, p. 10) shows gross of cost, equipment and one of two transfer attach as cost of V-tail. Heinkel plans aircraft production if 20-25 initial low orders are received.

HE 211B-1 Designed as DC-3-Type Replacement

New view shows transfer attach for two General Electric CRJ60-26 turbofan powerplants. HE 211B-1 is one of two Heinkel design entries, recently in a patent application for Douglas DC-3-type transport. Models were displayed at Hannover air show (AW May 24, p. 56).



Hughes makes news in rotary wing flight!

Hardly more than a generation ago, practical rotary wing flight was largely a promise.

Since just after World War II, when the Hughes Tool Company/Aircraft Division embarked on helicopter development, the industry has grown more capable of meeting the need for new and better craft.

However, the contributions the rotary wing industry can make are just beginning. These examples of Hughes Tool accomplishments, and its plans for the future, demonstrate that fact. For today, rotary wing flight holds the promise of revolutionizing man's transportation patterns.

The Hughes Tool Company/Aircraft Division is putting all of the ingenuity, skill and resources at its command into making that promise a reality.



The Hughes XH-17—First Large Pre-rotor-Jet Flying Crane. Capable of lifting 47,000 lbs., the XH-17 proved the feasibility and the advantages of jet power for rotary wing craft. Built and demonstrated at the Hughes Tool Company/Aircraft Division facilities in Culver City, California, the XH-17 flew numerous tests from 1952 through 1955. This invaluable experience—in the techniques of jet engine installation, in the design of complex ducting, in the development of pre-rotor structures—has led to several new Hughes advancements in turbine powered craft.

The HO-2 Met or Extended Alt. Guarantee. Designed specifically to meet the Army's need for a low-cost, light two-place helicopter, the HO-2 prototypes were outstanding demonstrations of Hughes Tool Company capabilities. With a high power to weight ratio, small rotor diameter, rugged structure and over-all simplicity and integrity of design, the HO-2 easily met or exceeded all guarantees.



New Hughes H59A Cuts Commercial Helicopter Costs in Half. Now in volume production at Culver City, the Hughes H59A has met with immediate commercial success. At the low cost of \$22,500 and delivering top performance at a 13¢ per mile cost, the H59A fills an important civilian transportation need. Owners praise the H59A's 360° visibility, its very high maneuverability, responsive controls, unusual stability and ability to get in and out of small areas.



The HO-4—4-Place LQH for the U.S. Army. Winner of a development contract in the Army's Light Observation Helicopter program, Hughes Tool will deliver several HO-4 prototypes for evaluation. The HO-4 will have forward speeds in the 140 mph class. Its payload will exceed 1,000 lbs. Its compact size, small rotor diameter and folding blade features will enable it to operate from tight quarters and provide for easy concealment. Taken together, the HO-4's capabilities promise exceptional performance over the mission spectrum, from combat rescue through logistic support.



Hughes 4-Place, Turbine-Powered 269 Civilian Helicopter. Adapted from the Hughes Tool Company's HO-6 design for the Army, the 269 would fill the important need for a low-cost 4-place helicopter for civilian use. It would offer the same high speeds and high load capacities as the HO-6. And compact size would allow more efficient operation for all types of applications.



Revolutionary Hot Cycle Rotor System. Proves in recent 60-hour tests, the Hughes Hot Cycle Rotor System ducts the exhaust from the gasifier section of a T-61 turbine through the rotor blades. This extremely simple and efficient passive propulsion system results in favorable payload to weight ratio, lower over-all operating costs and new ease of maintenance.



Hughes Hot Cycle-Powered "Flying Crane." Utilizing Hughes advanced propulsion system, this flying crane configuration could transport a payload of twenty tons for short flights. The performance advantages of the Hot Cycle Rotor System make this concept highly feasible—providing a lighter, more easily maintained, more efficient flying crane.



The Hughes Military Compound Jet VTOL Transport. This advanced VTOL concept utilizes the efficiency of the Hughes Hot Cycle Rotor System to their fullest advantage. For lift, the hot gases are expelled from the blades. For maximum speed in forward flight, the hot gases are diverted from the blades to two ducted fan propellers mounted on the fuselage. This compound configuration allows an aircraft weight of just 13,000 pounds with a correspondingly high 5-ton payload, 300 nautical mile radius capability. Other advantages of such a military VTOL would include: self-deployment with a ferry range of 2,500 nautical miles, high cruise speed of 250 knots, multi-mission flexibility, low maintenance needs and lower cost operation due to the elimination of mechanical complexities.



Outstanding Design and Production Capability. At Culver City, California, the Hughes Tool Company/Aircraft Division has one of the industry's most complete rotary wing facilities—now producing Model 269A helicopters at a one per day rate in its over 400,000 square foot manufacturing area.

The Hughes Tool Company/Aircraft Division has the imagination, the experience, and the production capabilities which will help keep it a leader in the rotary wing world of tomorrow.

Hughes Tool Company
Aircraft Division, Culver City, California



AIRLINE OBSERVER

► Aircraft operating through Federal Aviation Agency's eastern region were involved in at least 40 near mid-air collisions during 1967's first quarter. During the last six months of 1966, 90 such incidents were reported to FAA. It was discovered that eastern region air traffic controllers posted one flight program strip that showed an aircraft over an instrument fix, failed to post three others, cleared one strip incorrectly and violated FAA separation criteria in 21 instances from Apr. 1, 1966, to Nov. 31, 1967. During that span, there were 95 incidents requiring disciplinary action. Of these, 52 involved repeat offenders and only three resulted in controller disaction.

► Military Air Transport Service is expected to stand Fiscal 1968 commercial airline contracts representing the largest single passenger in Air Force history. Initial purchase of seven new aircraft for Fiscal 1968, now being negotiated, will be substantially larger than the annual Fiscal 1967 award of \$46.4 million. Through Apr. 16, MATS had received a total of \$22.9 million in Fiscal 1967 funds for commercial flight procurement. The company has 564 million in Fiscal 1966 and 533 million in Fiscal 1967.

► Look for U. S. air carriers that contract with Military Air Transport Service to step Air Force to underwrite "war risk" insurance chosen under which the airlines would be indemnified for losses resulting from combat activities, at least one recent instance, a transport operated by Pacific Airways was newly added destruction in Saigon, South Vietnam, where the aircraft on which it was parked was struck.

► International Transport Workers Federation has warned the Labor Department that it will support any strike called by its affiliate, the Flight Engineers Union International Association, over crew complement issues on Trans World Airlines and Pan American World Airways. FIDA has been legally free to strike Pan American for nearly a year and on June 2 will be legally free to strike both TWA and Eastern Air Lines. The engineers' union contends that negotiations with all three airlines have failed because the companies prefer to await the final outcome of current arbitration talks between the Air Line Pilots Union and Pan American.

► Passenger traffic on the North Atlantic showed a 26% increase during the first quarter of 1967. Number of scheduled flights increased 17% in the same period but available seat miles rose 24.5%, dropping load factors 1.7%. Fourteen lead factors for the period saw 12% while average load factors were 51.5%. Total of 511,821 passengers flew economy and 41,339 flew first class.

► New electronic and telephone developments are threatening to make the need for an travel less urgent, Harry F. Guggenheim, chairman of the Cornell Guggenheim Aviation Safety Center, warned last week. He said that new methods of transportation, such as spacecraft, and new routes and directions for greater speed, comfort and safety being provided by land and air transportation agencies are meeting new forms of competition for the airlines.

► British European Airways scheduled services were back to normal last week after withdrawal of its strike by airline technicians who refused to work on aircraft maintenance in a wage dispute (AW May 14, p. 41). BEA cut services in half and estimated the dispute cost it \$100,000.

► Russia's Aeroflot and East Germany's Deutsche Luftfahrt have placed transport Tu-104s on their jointly-operated Berlin-Moscow run. The Tu-104s will make three round trips weekly. Service between Berlin and Moscow with four-engine-propeller Il-62s will continue as before.

► Honolulu's new \$27-million terminal complex at International Airport is now scheduled for opening in September. Postponement from the original July 2 target date pleased the airlines, since they did not want to get involved in the move during summer travel peak.

SHORTLINES

► All-Allegany Airlines' income passengers totaled \$6,161 during April—a 25% increase over April, 1967. Cargo carried rose to 1.5 million lbs. during April, the an increase of 16.5% over the same period last year, the airline said.

► American Airlines' Coastair 950 aircraft on New York Chicago routes have experienced an average load factor of 72% during the first six weeks of operation beginning May 13, the airline said.

► British customs officers are asking flight pay for assignments to routes between Pittsburgh and London, where their job is to keep overseas and domestic passengers from mixing and possible passing dutiable goods.

► Eastern Air Lines showed a \$17,000 net profit after taxes for the first quarter of 1967. This is the first quarterly profit since 1959, the airline said. Losses for last quarter of 1966 were \$1.5 million.

► Part one of the New Federal Aviation Regulations, a simplified, codified version of the FAA's regulatory material including the Civil Air Regulations, is now available from the Superintendent of Documents, Government Printing Office, Wash., 25, D. C. Part 1 contains definitions and abbreviations which will be included in future parts of the regulations, which will be released within 12-15 months. All parts will be in loose leaf form to facilitate filing future amendments and additions.

► Flying Tiger Line has begun contract cargo service with CL-44 transport aircraft. The CL-44 cuts 2 ft. from the airline's 204000 Constellation all-cargo schedules over the route's biweekly service between New York, San Francisco and Los Angeles.

► Japan and the United Arab Republic have signed a bilateral agreement which will allow Japan Airlines and United Arab Airlines to conduct Cairo-Tokyo service beginning this fall.

► New Zealand's severe shortage of air traffic controllers has brought C. H. M. Kerridge, controller of air services, on a recruiting trip to London. New Zealand requires controllers to have flight crew experience, thus limiting local recruitment.

► U. S. citizens spent \$600 million for overseas air transportation during 1967, compared with \$266 million for ship travel, according to the Air Transport Assn.



To select and automatically maintain a constant rotor speed

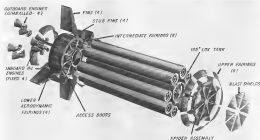


A comprehensive clouded fuel control system for the Gnome gas turbine helicopter engine has been designed and developed by de Havilland. This compact, light and rugged equipment, which is now in full production, is one example of our advanced design and development capabilities. Similar modern techniques can be applied to all gas turbine control systems, to provide a very flexible method of controlling many difficult control parameters.

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CLUSTER of 79 in. diameter fuel and liquid oxygen tanks around central 105 in. liquid-oxygen tank on Saturn first stage is visualized in this concept art by Vought Aerospace. Saturn will be first vehicle to undergo full-scale test and will also flight test National Aeronautics and Space Administration's Space Shuttle main engine.

Vought Producing C-1 First Stage Tanks

By Erika J. Balkus

Dallas, Tex.—Vought quality control which includes 100% X-ray inspection of 400 ft of precision welding results production of the large fuel and oxidizer tanks being built here by Long Trench Vought's Aerospace Division for the Saturn C-1 first stage.

Vought's Aerospace is fabricating 42 fuel and oxidizer tanks each 79 in. dia. and an 105 in. dia. liquid oxygen tank for the C-1's first stage. In SA-1 through SA-3 plus a dummy tank stage (SA-4) under a \$147,013 contract with National Aeronautics and Space Administration's Marshall Space Flight Center Huntsville, Ala.

Contract includes by a gross 79-in. dia. tank and a gross 105-in. oxidizer tank set will consist of a new tank cluster nearly 22 ft in diameter of four 79-in. RP-1 fuel tanks and four 105-in. dia. liquid oxygen container enclosing a 105-in. liquid oxygen container holding C-1's eight Rocketdyne RB-108 engines about 67 ft long.

First delivery, a 79-in. dia. tank, was made to Huntsville with last month. A series container is scheduled to have been made.

Containers are essentially aluminum alloy components, a number of cylindrical skin sections being welded to-

gether and topped by hemispherical domes, each containing fittings for piping and valves.

These sections are fabricated of 5056 aluminum alloy half-inch plate which start out as an 85 in. square blank. Various checks hold the blanks until a specific half 36-in. length where it is fixed on both ends and subjected on one side to backstress ranging from 425 in. at the edge to 150 in. at the center in preparation for their final. Tolerances of .005 in. are maintained.

Following customer's price, in they are mounted on a stand on the same little do actual delivery. Mounted in per hole to 180° to cut the forming process and gas pockets plus on the material to maintain its temperature. In that of the finished tank it is prepared, developing a diffusion range to a depth of 16 in.

The distributed pressure field is then stress relieved in an anneal and mounted on a 105-in. dia. tank from ring to do final configuration. The rings being clamped during the 15 min process, resulting in the finished half-inch having a depth of 16 in.

Wall thickness tolerances are maintained to plus or minus .005 in., although dimensions are to .0050 in. Although diameter tolerances are

approximately .005 in., tolerance of .0049-.0050 in. is achieved in one tank.

After leaving in the hydrostatic, the tanks are returned to the 5056 plate for forming and joining. Closeout welding is then performed to reduce weight in some critical areas. Because Vought's hydrostatic equipment has a maximum capacity of 750 in., the tanks for the 105-in. container are subcontracted to the Muscle Air Division of U.S. Chem-Milling Co., Muskogee, Okla.

The 79-in. containers are made up of 14 circular skin sections welded to girths. These skin sections, of 5056 aluminum alloy plate, start out as one length to one-quarter inch thick sheets 150 in. long x 36 in. wide. These are vacuum-welded in a 12 x 36 ft air-tight controlled atmosphere chamber from the interior of the skin into to reduce thickness in some critical areas. First rate a 90 in. per minute with the cutting speed being 1,000 rpm with cutting tolerance of .001 in. being maintained. Two skin sections are cut simultaneously on the mill.

After cutting, skin are self-formed and then are passed through five baths to clean them prior to longitudinal welding.

Individual skin sections are then



SATURN S-1 tank fabrication and assembly are showing completed 79-in. diameter containers (left) and end section (right).

longitudinally welded on an internal T-joint welder and then are taken to a lathe for trimming.

Assembly of domes and container skin sections into the 67-ft long tanks by south, consists of welding the domes into top and bottom skin sections and adding a ramp with ports for loading in empty fuel or oxygen to the air section. The assembly containing the ramp is measured in a large container control welder, with circular skin sections added on a positioning device as each section section is added to make up the completed tank. To maintain a high degree of quality control in all welding operations, a test strip approximately 24 in. long is welded prior to each production weld and this is taken to a lab for X-ray and tensile tests for approval before each operation begins.

Production Weld

Completed production weld is then 100% X-rayed on the next following each production weld. Tensile and gas welding is utilized on the flame-welded fuel tanks and outside most gas welding on the bottom liquid oxygen tanks—two hydrogen gas tanks, each as balanced with Aron equipment and the electric work die container are soft age. Aron welding equipment.

Welding is per ARMA (Aerospace Reliability Manual) Agency 970.027 specification. Spaced with multiple passes in approximately 28 in. from a with long skin approximately 14 in. from.

Following assembly of the tank sections into a single container, the tank is temporarily filled with natural gas and baskets and is then taken to a vertical 90 ft industrial test tower outside the assembly plant. Here the tank is loaded with distilled water and degassed, followed by a 10 min. with de-aerated water. The pressure portion of the tank test is a 100-lb process, with an initial one-hour cycle at 10

psi and then from 15 min. cycles at 35 psi. Water contains fluorescent dye to permit visual inspection for damage, after which is pumped out.

Tank is attached to the plant's final assembly area where it is connected to a mobile cleanroom for final installation of fittings, by personnel wearing heat-reflecting suits and masks.

Tank is then returned to the hydrostatic test basin where pressure tests are again conducted and the container's internal structural reinforcement perfor-

ated, combined with internal liquid at various levels. On this second pressure test only de-aerated water containing sodium deuterium with sodium material is used. Following successful testing the tank is then taken to the paint shop, then is weighed to determine center of gravity.

Tanks are shipped to Huntsville in a special container designed and built at Vought to withstand 1g of shock in any direction, the tank being suspended by airbags in its four lifting points.



INITIAL DISHING to finger depth of 16 in. is performed on dome plate mounted on a stand fitted to 79-in. tank. Gas makes facilitate rolling process.



DAGE RGS-10...

... "WATCHDOG" FOR THE ATLAS MISSILE

Television has assumed a variety of important roles in military communications. Perhaps none is as essential as in the activation of missile sites for America's Atlas defense complex. Dage RGS-10 television systems will soon be at every operational Atlas base across the nation. They will be needed for observation of fueling and test firing, surveillance and other key operations; the systems must perform under the most rugged environmental conditions possible for TV equipment. Why was the Dage RGS-10 system picked for this critical application?

Recently, the Air Force's Aerospace Division of General Dynamics performed a series of tests on several closed circuit TV systems to determine which could take the roughest punishment encountered in Atlas Systems support, and still produce sharp, clear pictures. The Dage RGS-10 was the system that met all the following requirements:

- Shock (MIL-E-8838B Proc. 2) and Vibration (MIL-E-8838B Proc. 1) Rating when though, these two tests must prove that the camera can "take it" while directly mounted on aircraft or in missiles.
- Explosion Proof (MIL-E-8838B Proc. 2) Certified that the camera can contain an internal explosion of 100/130 cubic inches at grade.

- Satisfactory operation at flight levels of less than one foot-candle
- Satisfactory operation in temperatures from -30°F to +50°F.
- Certified operation under noise levels of 150 db., permits direct, close range observation of rocket blasts.
- Insignificant radio interference.

Here are a few other applications of Dage television systems:

Observation of explosive materials	Missile Port observation
Army Chemical Center—Maryland	NASA—Wallops Island, Virginia
Penetration testing	Penetration observation
Patrick Air Force Base—Florida	Hunter—Washington
Hawthorne test observatory	Eyes for remote controlled tank
POMI Argonne—California	Port Belvoir—Virginia
Rocket engine test observatory	Ad-weather relay observatory
Red Stone Arsenal—Alabama	On-site Naval Air Station—Cali

Other features of the Dage RGS-10 camera:

- 760 lines Horizontal Resolution at 15 ms. Bandwidth
- Complete EIA synchronization and scanning exceeds FCC requirements for commercial telecasting
- Multiple camera systems, common or individual EIA sync generators
- Completely transistorized construction
- 15 Watt power requirement
- Unlimited altitude operation
- Optic system fully enclosed for complete protection
- 4 lens barrel, zoom lens, gas and tilt, and remote focus available

The Dage Division of Thompson Ramo Wooldridge provides a wide range of cameras, controls, monitors and other equipment as well as complete systems engineering and field service. If you would like to learn more about the Dage RGS-10 and other Dage closed circuit systems and development capabilities...

Contact the nearest Dage (TRW) regional office—Atlanta, Washington, D.C., Los Angeles or Salt Lake City, Utah.

Central Dage Division Direct—Michigan City, Indiana (or)

Check the Yellow Pages for your nearest Dage distributor.



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Any or all Time Codes...

off-the-shelf from **ASTRODATA**

ASTRODATA can give you, in our standard instrumentation as standard instrument prices, any practically used time code format for up to 6 codes simultaneously. You can choose from more than 30 standard options, all conveniently available off-the-shelf. Only Astrodata can honestly make this offer.

Astrodata's complete line of solid state time code equipment is built to MIL, requirements around modular plug-in circuit cards. Right now cards are on the shelf for all time code formats in use today, including SRG0 Memorex A, B, C, and D, NASA 36-, 71- and 30-yr, Atlantic and Pacific Missile Range, Eglin, White Sands, etc.

Using these standard modules, and combinations thereof, Astrodata supplies "custom" generators/transmitters in the shortest possible time and for the lowest possible price. No costly engineering design is involved.



TIME CODE FORMATS

Now built-in to popular off-the-shelf equipment used time code formats. Contact for a complete list of available options in Astrodata Pattern Read, Astrodata Inc. 340 E. Pines Road, Anaheim, Calif. 92701. Phone PR 8-3300 or TNA 4N 1202.

Astrodata's approach also avoids early obsolescence. The user can add and subtract modules with ease, instead of a complete new generator or transmitter, he orders new cards as he would spare parts. As new code formats are developed, Astrodata develops new plug-ins at once.

We advise you to investigate, and will be happy to supply names of customers in your area.

Example of Astrodata Time Code Equipment



SUPER 3000 TIME CODE GENERATOR

Available for generating all time code formats, Model 3000 is built to 100 psd duty with internal frequency standard, also precise synchronization to external frequency standards, multiple simultaneous serial time code outputs, 10 simultaneous pulse rate outputs. It can be used for 1 psd or wider, 3 channel wide, changeable plug-in power supplies (50 kpm, 400 kpm, 25 k/Hz) completely transistorized.

the test assembly (Strick) had proper trace which turned out to be healthy and devoid of any abnormality.

A comparison of biochemical tests was conducted, varying under the action of stress factors and showing variations were noted in a very biological action of these reactions and other factors of BOM.

The obvious comparison of the blood at non-specific chemotactic activity, the amount of 21 and 28 leucocytes and other nuclear products of the metabolism of nuclear acids (deoxyribonucleic and other nucleic acids) were lower compared.

Biochemical changes of different organisms were observed when they were tested and the higher and other light is employed exactly and sharply.

In other one effect under laboratory conditions (0.8 units, 1.5 units) or vibration (70 Hz, amplitude 0.4 mm, 1.12 mm) during 14 days an increase of non-specific activity of cholinesterase and a decrease of the concentration of serum proteins in the blood were observed.

These changes, both in activation of the function of the liver and other systems of the organism.

In contrast to this at multiple sections of the above mentioned factors in a number of cases the dysplastic condition was revealed for which a stable center of the concentration of serum protein and alpha-2 globulins in the blood was typical and this a decrease of the total quantity of protein of the organism of different factors. Such changes were observed after a series of light tests in animals showed biologically significant results.

Examination of two dogs, which made short-term long-term light tests showed dysplastic changes in the metabolism in comparison to the control group of animals.

Analysis of the blood and urine of the tested dogs, rats and mice which made a 24 hr. orbital light revealed changes due to the stress reaction in various directions to recover. Analysis of the blood revealed an increase of alpha globulin serum protein and grand protein of the blood and a decrease of the cholinesterase activity.

At the same time an considerable decrease in the metabolism of nuclear acids was revealed.

Examination of animals during the test

Gamma Radiation

Possibility of extending the operation of an optical meter forward to ultraviolet into the gamma ray region, and thus getting sufficient range from such a device to cover the entire spectrum can be explained as a following program: your word by the Lohr-Wagner Group in VSE's Automated Systems Division.

One aim of the program is to "restore" of the loss can be pushed forward what is regarded as its practical operational limit in the ultraviolet. At some of the program actually substituted for the program indicates a feasible approach to fix the program can look at more conventional gamma sources as possible use in a workshop.



This printed circuit disc is the "face" of a clock that tells time in digital code

...or any code your computer, control system, or data processing device needs to keep it properly in touch with the world of real time—A. W. Hayden is a company of infinite variation when it comes to such analog-to-digital converters, or "binary encoders". Time periods range from seconds to weeks. Sizes range from miniature to large. They come sealed, enclosed or open, with AC, DC, or pulse drive, and with an imposing variety of accessory equipment—The model shown is for commercial use. It provides a discrete signal for each two-minute interval over a 28-day period. It is used, among other places, in an automatic parking lot ticket computing system—Thus and several other time code generators are described in Technical Brochure SP9-2. It's yours for the asking. Similar solid-state devices can be supplied by our Culver City, Calif. facility.



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ASTRODATA INC. Successors to
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Raytheon 20 joule Laser penetrator about to explode below

Raytheon / Laser Military Systems Applications

One of the first to develop an operating laser, Raytheon has since directed its efforts toward high energy lasers for systems applications. Ruby, other solid-state materials and gas lasers are being studied to determine their ability to produce pulsed or cw coherent light. Raytheon's extensive background in designing power supplies for high power microwave equipment has rapidly advanced its laser development.

Application of laser principles now being explored at Raytheon include communications, illumination,

aids in imaging, underwater systems, airborne altimetry, guidance/velocity sensing, ranging/detection systems and weapons.

Of recent, Raytheon will demonstrate its equipment and discuss laser military and systems applications. For complete details, write: Raytheon Company, Equipment Division, Department 888, Weyland, Massachusetts.

RAYTHEON

after flight showed retention of the above values within the limits of the norm.

Apparently single short-term space flights of animals do not cause irreversible changes in metabolism characteristic of space sickness.

Analysis of peripheral blood of test dogs, rats and mice did not show any pathological changes of white and red elements of the blood and the content of hemoglobin. In a number of cases after flight, rapidly disappearing retention of the number of leucocytes were observed.

Immunological investigations have shown that the series of series of acceleration and vibrations affect chiefly the clearing function of neutrophils. For instance, acceleration of 2 units leads to elevation of the phagocytic ability, and acceleration of 412 units reduces not only absorbing, but also digesting ability of neutrophils. Bactericidal properties of the skin relative to 3 rats at cruise at a level of acceleration and vibration.

No change of the natural cutaneous infection and bactericidal properties of the plasma at the end action was observed.

After flight aboard space ship 2, some less retention of the index of the immunological reactions of both dogs were observed when the periods of depression of reticuloendothelial function observed both their retention.

The decrease of the number of neutrophils on the skin, the increase of bactericidal property of the skin and the activation of the phagocytic function of neutrophils should be considered as the most significant change of the dog's metabolism.

In certain specific immunological reactions reached the level of strong effect. The same, but less expressed change of the reactions is revealed in dogs which made flights aboard space ships satellites 4 and 5.

Remarkable is the fact of decreasing the immunological reactions of the norm in repeated effect after return.

Cytological and histological investigations were conducted on specially selected cases of both even (breeding) and old pure C57 black blood-bearing animals. The control systems (heart, lungs, spleen, etc.) were healthy.

In the cells of the center of the nose, which were found space ship-satellite 1 as evidence of chromosome variations due to mutation at the stage of the completion of mitotic division is compared to the norm. For instance, the chromosome variations of the first pair of animals amounted to 7.1% of the number of the cells examined versus 7% revealed in control animals.

Consequently, we also the discussion at the chromosome retention of the cells of the nose of the nose which made space flight and was isolated by means of the method of the total flow of 50 metaphases. In the cells of the system of the nose which appeared from flight, investigations were observed complete almost at the chromosomal mutations and the chromosome variations were apparently not the result of the capture of chromosomes, but of their staining and subsequent incorrect development.

Finally, the morphological analysis of the nose marrow revealed an increase in leukocytes with the appearance of young

forms and also the deposition of osteopontin. No deviation from the norm was detected as to the peripheral blood of these animals was observed.

Histological investigations of the spleen of mice showed the depression with the consequent recovery of the blood-forming function of the spleen.

At the same time cytological, histological and morphological investigations of the animals of mice which made short-term flights aboard space ships satellites 4 and 5 did not reveal expressed changes in compared to the control group.

The results of experiments specially set for the studies of the influence of acceleration and vibration on blood-forming organs have shown that such mechanical factors as

vibrations is capable of causing the chromosome staining and the changes in the morphological picture of the marrow.

In one experiment of osteon trabeculae exposed on space ships satellites and then run planted to denote the degree of vitality is revealed identical to control specimens. The exposure of all test bacteria in automatic devices-bactericides in space ships made it possible to evaluate the suitability of the method for determining the action of space flight factors in long-term flights.

The investigation of the culture of 8 rats K12 B and progenies has shown that the number of vital organisms in experimental cultures is practically equal to the control. No significant changes of biological and breeding parameters were revealed in



A PRODUCT OF DELAVAN EXPERIENCE


The opening T33 small gas turbine engine is currently used on helicopters, observation aircraft and in Marine and industrial applications. This is the fuel injection nozzle developed by Delavan for the T33.

If one word were chosen to sum up the reason for Delavan's success on this fuel nozzle program, that word would have to be experience. Experience in designing highly functional, reliable fuel delivery and metering devices, ex-

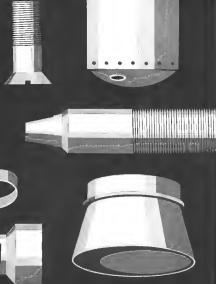
perience in large scale manufacturing of the millions and millions that make up a fuel nozzle, and experience in controlling the quality and performance of these devices on a mass scale.

Add this experience to Delavan's willingness to react quickly to the urgent needs of a dynamic industry and the results are always the same... excellent quality, a good delivery record, and reasonable prices. No one Delavan is a part of your engine program.

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We put the earth and the moon in this box—and backed off a billion miles

This is an earth-moon simulator developed by Northrop. As its name implies, it shows as how the earth, or the earth-moon system, would look to an observer in space, from 80,000 miles all the way out to 1 billion miles. It was built to test the sensing devices which space vehicles use to track the earth, so they can guide themselves and point their communications antennas at the earth.

The earth-moon simulator is not only an important research tool, but also a major step toward quality control in space systems. It was designed and built by the Northrop Division of Northrop. It will be used by Caltech's Jet Propulsion Laboratory, contractor to the National Aeronautics and Space Administration.

NORTHROP

about observable biological action of space flight. However, it should be known as well that these data should be considered as preliminary and relating to the need for biological support, rather than methods of investigation. Further work is to show to conduct a complete analysis of the whole system obtained. Besides it should be to establish that present conditions are valid only for specific conditions of the projected flight experiments over the earth at space ship altitudes over the earth's surface, and the distance of flight was relatively short.

Test Results

As a result of flight experiments with animals aboard space shuttles, scientific data were obtained which made it possible to draw conclusions about the possibility of manned space flight.

A program of the selection and training of astronauts was carried out, and animals were used in the evaluation of experiments with animals.

Photo Y. A. Gopov and G. S. Tikhonov chose for the realization of the first flight.

L-T-V Wins USAF Metal Study Contract

Dallas, Tex.—Extensive research in metals forming will be carried out by Loyd Tanco-Vought, Inc., under a \$75,000 contract from USAF's manufacturing technology laboratory of the Aeronautical Systems Division.

The analytical studies will cover the best techniques presently available and determine requirements for future work and process refining with materials as aluminum alloys, titanium alloys, beryllium, tool steels, super alloys of nickel and cobalt and stainless alloys of molybdenum, chromium and tungsten. These materials will be formed in temperatures of up to 2,800°F and subjected to pressures up to 50,000 psi.

High-velocity techniques will also be investigated using explosive, electro-explosive, electrohydraulic and piezoelectric shock cell processes.

NASA Contracts

National Aeronautics and Space Administration recently awarded the following contracts and research grants:

BRANDENBURG, Washington, D.C.—\$200,000 for research on mechanical behavior of the stabilizing and restraining mechanisms of solid rocket motors.

McDonnell Douglas, St. Louis—\$1,000,000 for research on the effects of high speed flow on the aerodynamic characteristics of aircraft and spacecraft.

General Dynamics, Fort Worth, Tex.—\$1,000,000 for experimental research on aerodynamic characteristics of aircraft and spacecraft.

Study of selected preliminary work on the aerodynamic characteristics of aircraft.

University of Connecticut, Storrs, Conn.—\$100,000 for research on the aerodynamic characteristics of aircraft and spacecraft.

Northrop, Northrop, Northrop, Northrop—\$1,000,000 for research on the aerodynamic characteristics of aircraft and spacecraft.

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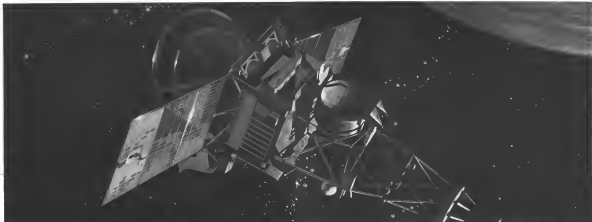
dimensions from 18" to 120" (immediately above, a 60" explosion-proof model). And in each size, many model options are offered . . . from free wheeling to programmed positioning. Write for complete details today.

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Room for Space

Hughes Aircraft Co. has developed a new plastic foam material for building light weight structures with applications in space. The material, a porous plastic foam material, was developed under an Air Force contract to build structures in space such as shelters, antennas, and even launchable rockets. The foam is placed in the area to be used and then the desired shape is formed by inflating it from an open structure under vacuum to take the desired



WING-ALWAYS - solar elements for the future launch vehicle, lunar landing spacecraft, and high-speed hybrid ships are among the advanced electronic guidance and communications systems now being created by Ryan Electronics



FLYING SOLAR NETWORKS can provide a source of power for space vehicles. This model, 18 feet in diameter, was completely engineered and fabricated in just a few months by Ryan's engineers and highly skilled metallurgists



MARINE LINK between space vehicles and earth is the Anisot which makes possible two-way communication. Lightweight, precision Space Anisot, capable of withstanding harsh launch and space environments, are being developed by Ryan

How to power Venus-bound space probes?

Ryan Aerospace is producing lightweight solar panels which will support thousands of tiny photoelectric cells to harness the sun's energy in space. The cells will generate the electrical power needed for the controls, experimental and communications systems of Venus space probes and earth satellites.

With broad experience in systems management, Ryan engineers are developing power systems, communications systems, and advanced space structures to meet the requirements of space vehicle programs. These capabilities are geared to fast reaction time in keeping with the demands of planetary orbits and sudden shifts in program schedules.

Flexible, fast-moving Ryan is also making significant contributions in the areas of VHSIC aircraft, Doppler sensing and navigation systems, and Flex Wing applications. And Ryan is the world's largest producer of jet target systems for the Armed Services.

Your inquiry is invited concerning the total capability of Ryan Aerospace and Ryan Electronics in space age design, development and fabrication.

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for Post Office National Mail
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the "Twin Falls Station" in connection
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ATLAS RESEARCH CENTER, Santa

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—\$100,000 for research and development of
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From the Air Force QF-80 and QB-17 to the Army 124-E... SIX YEARS OF DEL MAR DRONE/TOW TARGET EXPERIENCE

Early in 1953, Del Mar Engineering Laboratories demonstrated the feasibility of conducting successful drag success against tow targets that were carried aloft and launched in-flight by trained aircraft. This pioneer work was done in cooperation with the U.S. Air Force's Drone Group at Field 5 Edwards Air Force Base. The drones used at that time were the QF-80 and QB-17. A short time later, Del Mar, working with the Air Force's Advanced Center, introduced still another new concept—The Pegasus Test. It consisted of an unreplicable sophisticated Delta Wing Target complete with Kurenski's remote control equipment. From which was launched an expendable, low-cost, radio reflecting tow target.

Now Del Mar has gone on to lead in state-of-the-art development of a vast variety of weapons training systems tailored to meet the specific needs of the various branches of the Armed Services... and more than 100,000 Del Mar targets have been employed in military operations throughout the Free World.

Today, Del Mar is participating with the makers of the Army's 124-E drone—Ryan Aerospace of San Diego—in the development of a drone/tow system employing the Del Mar tow target and Ryan Pegasus drone. The new system is being developed for use as training Army missile batteries.

The Ryan Pegasus/TOWFREE system will provide the U.S. Army with all of the safety and the cost savings associated with an unmanned tow system.

For more information on manned or unmanned tow target systems and related weapons training concepts, write Dept. AF-10336.



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QF-80 drone released with Del Mar B-57C while releasing tow target.

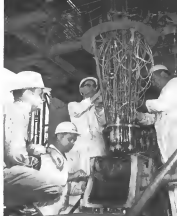


Del Mar 124-E drone and B-57C while releasing tow target.

Small Scale Models Of F-1, H-1 Engines Tested at Marshall



MARSHALL SPACE FLIGHT CENTER technicians test a series of small scale engines to determine final design of Saturn test vehicles. Models are in two lower orders, 1/25 and 1/35, with F1 models producing 100 lb. thrust and F1 models producing 4,000 lb. thrust. F1 model, left, and cluster of five small F1s are prepared for test.



SATURN G-1 MODEL, 1/35 scale, is studied for test firing at left. Vehicle is fitted with fins, as will be full size S-VS (intercept). Cluster group of scale models have reached 1,200 psi. and firings have lasted from 1.5 to 350 sec. Fins: Push right, model design, check fins on S-V model. New arrangement of the eight 38.1 nozzle and relative size of the fins in the 1/35 scale model.



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TACT systems won't become obsolete—can be expanded to accommodate future tests or extended to test pretest circuit boards, modular circuits, etc.

High Testing Accuracy results from reduction of contact and signal cable leakage and interference. Test circuitry cabling has been reduced to approximately one-tenth of other designs offering similar testing capabilities.

Repeatability of Testing is maximized by punched-card programming and remote control of constant test circuitry. Program cards can be retained and used indefinitely, ensuring high repeatability and a permanent record of test conditions.

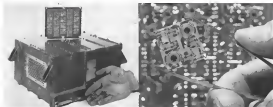
Nontechnical Personnel can operate TACT systems with minimum training. Reconfiguration can be accomplished in minutes without circuit board or plug-in change.

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MINIATURE DIGITAL COMPUTER, built with commercially available micro-components, a prototype of circuit data processor which would form the heart of proposed area integrated data processing, telemetry and display system for use on space vehicles.

New Data System Proposed for Space

By Philip J. Klein

Washington—As integrated data processing systems for use in manned space vehicles to enable the crew to function more effectively with less dependence upon earth-based facilities will be proposed here this week at the National Telemetry Conference by George G. Hoberg, American Bosch Arma Corp.

The system is intended to provide a number of functions which otherwise would be performed by separate instruments in the vehicle and on the earth. These include:

- **Automatic performance monitoring** of space vehicle subsystems and components, both internal and external, to select and display for the crew those of major importance.
- **Automatic data processing** of mass amounts of vehicle performance and environment so that only the significant data need be transmitted back to earth to conserve vehicle electric power.
- **Automatic shut-down** of vehicle subsystems during problems, in-flight and lesser ground post-launch operations.
- **Efficient simulation** in the actual vehicle for crew training.

The proposed system, a joint effort of the Telemetry and Data Division of American Bosch Arma Corp., is called *Diamond*. This is an acronym from Data Adapter, Evolver and Monitor, as well as the name of the deity of Greek mythology who presided as a guardian over the fates and fortunes of man.

As space vehicles probe out to distances measured in hundreds of thousands or millions of miles from the

earth, the power required to transmit large amounts of data back to earth for processing to determine how the situation is developing becomes prohibitive. Dealing with present payload limitations.

This suggests that it may be more economical and feasible to place the data processing equipment on board the vehicle itself and transmit back only the significant processed data. Additionally, this approach would reduce the lag time in making such decisions or trouble shooters in the earth and make it less dependent upon communications with the earth.

Although the desirability of on board data processing has been recognized, the computer normally required, comparable to an IBM 7090 has made the concept impractical until the recent advent of micro-miniaturized components and integrated microcircuits, as noted by Hoberg.

American Bosch Arma studies indicate that a *Diamond* system including a ground processor computer, a space processor data processor, a telemetry type vehicle display and associated equipment could weigh about 110 lb., occupy approximately 5.7 cu. ft., and consume less than 100 watts of power. Reducing the size, weight and power consumption of conventional instruments replaced by the integrated system indicates a "net cost" of about 0.5 cu. ft., 25 lb. and 152 watts, Hoberg says.

These size and weight figures are based on using conventional micro-miniaturized components, both active and passive types, which are currently available.

Use of thin-film or semiconductor

integrated microcircuits would permit a reduction in these figures.

The proposed system is based on the use of a standard TV type system for display of all significant data in the space vehicle cockpit. That would eliminate the need for a number of individual panel instruments and permit display of only that data of interest to the crew at the moment.

There would be two display scopes, one for the pilot and one for the copilot, with individual control panels enabling each to roll out and display subelements of interest.

When the computer is not occupied with crew-requested data, it will scan through a roll-call check on the performance of all subsystems, listing those against pre-set "go, no-go" criteria. When an out-of-tolerance condition is detected, an alert alarm will sound and the situation involved will be displayed on one of the scopes.

The use of scope type display, with an associated rapid generator, permits wide flexibility in the display format. For example, if the temperature over-ride warning exceeds temperature at one or more points on the vehicle's surface, the display can take the form of an outline of the vehicle in which the temperature at each sensor location is shown. Or if the tank is in the critical supply, a pictorial display of the electrical distribution system can be shown with voltages indicated at critical points. Availability of data processing equipment on board the vehicle is expected to be particularly valuable for conserving transmitter power down because of its ability to reduce the amount of data which must be retransmitted back.



AT RADIATION, CHALLENGE IS OPPORTUNITY

Example: Three satellites, three breakthroughs

PCM telemetry technology moves a step forward each time Radiation Incorporated engineers solve challenging telemetry problems of advanced projects. These include Nimbus, Telex, and most recently, NASA's Orbiting Astronomical Observatory. The far-out "observatory" will provide astronomers with a vantage point unobscured by our atmosphere.

The two-part OAO PCM system is constructed with unique fail-safe redundant channels for long life and handles both experimental and operational information. Although it has a 650 channel capacity, the system is less than 6 watts and weighs less than 40 pounds. The digital circuitry has a satisfactory operating probability of 99% for one year in orbit.

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RADIATION
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to the early onset of reporting back on the performance of all major subsystems, the on-board equipment can compare performance against predicted limits and determine when a level "off" self" signal except those three in device from expected performance.

For adverse performance conditions, the Decima system often transmit back not inside the current situation report but a local situation report to wall. For example, if vehicle data incorporate but not show expected values, it is important to know the rate at which the temperature is rising. This is the sort of processed information which Decima can provide with its on-board data processing equipment.

The present Decima data processor would consist of two extremely programmed computers. One, a high-speed general purpose total machine with a large, selectively addressed internal memory and a magnetic tape program library, would be used to control the second computer, a very high-speed machine, which would handle the processing of data obtained from decima at various on-board the vehicle.

A prototype auto-navigating computer recently built by Anco, is representative of the general purpose machine which could perform the Decima control function. The machine has a base clock rate of 1 mhz, performs an addition in 22 microseconds, multi-



AVIONICS PRODUCTION LINE of the future may resemble this Micromin assembly at Aerospace Electronics which makes water bonds that mount microcircuit components.

plies in 115 microseconds and divides in 328 microseconds, including accuracy of three microseconds. Word size is 25 bits. Present machines have a core memory with a capacity for 2,048 words which probably would be increased to 8,192 words to handle the Decima function. The machine is constructed from discrete, available, microelectronic components and weighs less than 10 lb.

The second machine, used for processing of measured data, would also operate at a 1 mhz clock frequency but would have an addition time of only nine microseconds, a subtraction time

of six microseconds and memory access time of three microseconds.

It is not known that Decima would be used to provide on-orbit computer service. However, it could be used as a contingency backup to the primary ground computers.

The report on Decima to be delivered here at the National Telemetry Conference is jointly authored by Hahn, chief engineer of the Tele-Dynamics Division, Leonard Finkel, assistant chief engineer of Tele-Dynamics, and Thomas J. Carr, head of the Atlas ground analysis section of the Anco Division.

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SCHUBERT PHOTO of shock wave pattern at Mach 3, taken in United Aircraft Corporation supersonic wind tunnel—use of several advanced tech. UAC used in developing Hamilton Standard variable inlet geometry controls.

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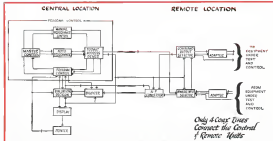
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FLOW DIAGRAM of main and space boundary checkout computer indicates functional relationship between remote units receiving sensing data from equipment being tested and controlled and central unit containing software programs, stored constants and random access

Integrated Circuits Cut Computer Cost

By Barry Miller

Los Angeles—Vidiotronic metal computer is being designed especially for remote and space location payload automatic checkout and testing, using on-chip circuits advantageously to reduce system costs and increase reliability in undergoing final testing at the Martin Co.'s Downer facility.

The computer system will be one of the first cosmic equipment to extensively incorporate semiconductor integrated circuits into its design. Its logic networks use integrated circuits throughout, about 2,000 of five different circuit types—half-wave rectifiers, pulse buffers, counter registers and flip flops.

Integrated circuits are semiconductor devices in which whole circuits rather than individual transistors or diodes are fabricated within and on a single central semiconductor disc. Many patterns of the circuit are formed simultaneously in a series of sequential processes.

Usually, the small size and light weight of these semiconductor devices are their most immediate advantages over conventional components, were not reasons for their adoption in this ground-based system. Further it was the expectation that integrated circuits would reduce the cost of the system that convinced the Martin Co. to adopt them as extensively as possible into system design, according to Herb Benzel, head of the development system in general equipment at Martin in Downer.

At the initial stages of the design,

Martin ran a rough cost estimate of the system, based on anticipated pieces of integrated circuits made by Fairchild Semiconductor Corp., which subsequently supplied the five circuit types employed in the system, and concluded that the cost of the system would be less than with conventional components.

The reduced cost estimates are partly predicated on the fact that integrated circuits reduce the number of individual parts in the system and thereby simplify building the machine. Martin feels that significant savings were derived from reduction in misassembling labor made possible by integrated circuits.

Integrated circuit manufacturers have maintained low costs but have recently desired devices for these devices the price would drop, making them economically attractive compared with equivalent circuit using individual components that need to be assembled, interconnected, adjusted and tested.

Devices of this type are expected to have improved reliability because of the reduction in the number of interconnection points among parts. The likelihood of higher reliability accounts in large measure for current military interest in and support for military integrated circuit developments and is another reason for Martin's decision to incorporate the devices in its new system.

Late last year, Texas Instruments displayed a small, lightweight digital core package (AW Oct. 14, p. 11) fabricated with its integrated circuit. The Martin computer, which is undergoing testing

and trouble shooting in Downer, will be an operating version of the system the company is presently attempting to sell to several potential customers, including the Air Force.

Integrated circuits used in the system, called MARKTAC (Martin Automatic Remote Test and Control) are part of Fairchild's popular product line. They are mounted on multilayer monolithic boards and enclosed within a conventional TO-18 package can. In the Martin design, these devices are connected into individual wicket modules, just as are conventional components also employed in the system. The modules are interconnected and inserted into large plastic assembly boards and then the main system interconnected by wire wrap. Plug-in modules can be replaced for maintenance.

The MARKTAC wicket consists of a control unit with an operator's console and a separate remote unit that is connected to the control unit by control cable. The remote unit will accept over 170 analog inputs, convert these into pulses and send them to a digitizer in the control unit. The MARKTAC system is capable of making over 400 different types of decisions, according to Martin.

Permanent records can be made by a tape printer connected to the control unit and/or displayed in real time by lights in either control station on the operator's control panel.

MARKTAC contains special initialization and safety features required for



INTEGRATED CIRCUITS, mounted on multilayer ceramic boards and enclosed within hermetic cans, are common, like conventional components, in sealed subassemblies and then encapsulated. Encapsulated subassemblies are inserted in board and their terminations pins are interconnected by wire wrapping as shown above. Integrated circuits are shown in one subassembly (A), conventional components are shown in another (B).



AUTOMATIC CHECKOUT equipment, developed by Martin-Davies for use in checking and testing and spare hardware, incorporates integrated circuits packaged in conventional miniature cans throughout digital logic systems. The digital multipurpose computer has assembly and display at right which accepts analog signals, converts them into pulse data, and passes them via coaxial cable to digitizer to control unit, shown at left with display panel.

branch control. The system also has special circuits to double-check critical features of assemblies at launch points.

The machine has several testing functions, with real time checks to detect faulty operation, on-line pre-operational checks to verify operating readiness and periodic off-line programmed self-checks to verify overall equipment condition.

Portions of the MARTAC system were scheduled to be displayed May 16 in Dayton at the National Aerospace Electronics Conference.

MARTAC is capable of taking a wide number of measurements, most of them over a number of range steps. These include:

- Voltage d.c. over 15 range steps, ± 100 mv, full scale lowest range and ± 500 volts full scale highest range, 10 meg ohm input impedance and maximum error of $\pm 0.1\%$ of reading above 1 full scale.
- Voltage a.c. (RMS), 12 steps, 100 mv, full scale lowest and 500 v, full scale highest, 10 megohm input impedance, frequency range of 60 cps to 10 Kc and 50 cps to 100 Kc and maximum

error of $\pm 0.1\%$ of reading above 1 full scale and $\pm 1\%$ of reading above 1 full scale.

- Time delay in seconds in one step, 1,000 sec. full scale or up to 100,000 sec. (1000 steps) with maximum error of ± 1 part in 10^6 per day or plus or minus one count.

Other measurements include resistance, voltage ratio, admittance, phase delay, frequency, and also decibel noise ratio.

TEST FILTER CENTER CELLS

- **Guidance System Slot Test-Fire** high-speed slot tests of the Stroh air launched ballistic missile integrated guidance system, developed in North Carolina by Northrop Corp., is scheduled to begin shortly at the Air Force Missile Development Center, Holloman AFB.

- **Growing Ruby Crystals**—New materials program centering on the growth of ruby crystals from carbon salts, and other for use in optical systems, is about to get under way at Letter Inductor Airtron Division. The effort will be supported by USAF contract of about \$25,000.

- **New Laser Materials Tested**—Naval Research Laboratory 1004445, liquid crystalline materials has been observed at liquid nitrogen temperature in a 300-micrometer-thin film—glass activated with one ratiometric scale per cent of hydrogen. Radiation emitted in the near-infrared region, at about 1.15 μ micron, according to NRL scientists.

- **Agnes D. Redox Sealing**—Florida recently new approach for testing the earth's horizon is being sought by Lockheed Martin and Space Co. for the latest in its Agnes D. Redox Sealing—the Agnes D. The current Agnes D. is placed in a closed system, as did its predecessor, the Agnes A. Industry prospects for the new system are being evaluated by Lockheed.

- **Master Lethal Ballistics Weapon**—Office of Naval Research will call a special meeting on December 14th to discuss the month of 14 companies which completed studies from January 1964 to September 1964 on lethal weapons (AW Apr. 15, p. 28). Purpose of meeting will be to discuss results of the studies submitted on May 1 and to announce future course of the Advanced Research Projects Agency program in laser weapons.

ANOTHER ADVANCED MICROWAVE TUBE DEVELOPMENT FROM RAYTHEON'S SPENCER LABORATORY



RAYTHEON PHASED ARRAY ASSEMBLY includes Amplifier? tube structure and Vial in shape position. Elements are made of precision machined materials and electrically provide identical performance throughout the array.

(Courtesy: Raytheon)

Raytheon tubes bring new modular solution to phased array problems

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Antenna gain	20 db	20 db	20 db
Frequency (Hz)	100-1000	100-1000	100-1000
Input	20 db	20 db	20 db
Output	20 db	20 db	20 db
Gain loss	0.4 db	0.4 db	0.4 db
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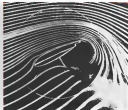


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TESABOF AIRFOIL



SMOKE TUNNEL TESTS show that inlet wing leading edge suction and blowing over flap (TESABOF) produces lift even at a 30 deg. negative angle of attack. Suction is created by the jet pump located at throat in the photo at left. Flap on the underside of wing is insulated to provide pitch and roll control. Ryan says the above system has applications in large VFWBOL transports.

Ryan Designs BLC-7 Light Twin Airliner

San Diego, Calif.—Full utilization of both suction and blowing techniques for boundary layer control (BLC) has enabled Ryan Aeronautical Co., engineers to produce a 54-seater, cruising speed for a light transport that would normally stall at 100 mph, and apply corresponding reduction to the company's BLC-9 light-twin transport.

Ryan's BLC system operates on the jet pump principle, which uses stored or regenerated jet fuel bearing in the suction. The system, according to Ryan, offers exceptional reliability, long a problem with BLC systems, and light weight.

The BLC-7 transport, a 5,000-lb., seven-place aircraft, was designed around the boundary layer control system to demonstrate system advantages. The BLC-7 is slightly smaller than the Aero Commander 500A, but has the same

general platform with the exception of a high T-tail.

The BLC-7 is designed for two 260 hp, incorporating an turbo-prop powerplants, and would cruise the approximately 1,200 mi at 330 mph using no auxiliary power.

Wing Specifications

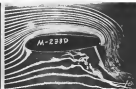
The BLC-7 has a deck high aspect ratio wing of 336 sq ft area. Wing span is 36 ft. Cruise performance is not compromised by leading and trailing edge suction because the BLC system makes such compressions unnecessary. Performance estimates indicate that the aircraft would take off over a 90 ft obstacle at 410 ft and land over the same obstacle in 400 ft.

Wing loading of the BLC-7 is a deck high 45 lb./sq ft. Its comparison, the Aero Commander 500A, has a wing load-

ing of 24.5 lb./sq ft.

Ryan Senior Staff Engineer Fred G. Wagner says that the stored energy system of BLC greatly reduces the possibility of failure of the system during the two most critical times of flight—takeoff and landing. Systems which use bleed air from a turbojet engine or depend on an auxiliary engine cannot stand along past for the takeoff and landing portion to provide pumping action, have been subject to entrance from a safety standpoint to pilots.

Except for the firm system is stated as the form of compressed air. In the case of the BLC-7, this would be under 3,000 psi in a 15-in. tapered steel duct. In comparison, other engine or hydraulic systems would be employed to replace the storage tanks. Pressure could be brought up to maximum during the end-of-takeoff period to



CLIP SECTION MODEL such as would be used on the Ryan BLC-7 is shown in a smoke tunnel. Note how the depression forms producing lift when suction is turned on, as shown in photo at right.



Bad weather costs big money. When ceilings and visibilities fall below minimums, jet operations in particular take huge losses, because of schedule disruptions, idle equipment, passenger and cargo diversions. Lower takeoffs and landing minimums are the answer, provided these can be achieved both safely and economically. They can, because Sperry has been at work for years on every aspect of the problem.

Sperry has made hundreds of fully automatic landings to date, solidly proving both concepts and equipment. First prototypes of the ultra-reliable master pilot of the future—the Sperry

SP-30 with built-in glide slope extension capability for upcoming Boeing 727 jet-liners—already have been delivered. The latest SP-30 system, in service aboard the Douglas DC-6, Convair 440 and 590, was designed with the automatic landing needs of the future in view. Douglas and Sperry already have demonstrated automatic takeoffs and landing approaches to the point of flare in the DC-6, employing SP-30 with glide slope extension and other advances.

Among new Sperry flight instruments concepts is a system which will electronically display runway approach lights on the pilot's windshield, in any weather.

Other "look-ahead" windshield displays are in flight test. Electronic monitoring and pilot warning systems, anti-collision and terrain comparison are in being today, and under continuing development.

The immediate Sperry goal is safe, economical reduction of landing minimums to 35 feet. A little further in the future are projected systems for automatic takeoffs and landings, adaptable to each operator's needs.

SPERRY

SPERRY PHOENIX COMPANY, DIVISION OF SPERRY RAND CORPORATION, PHOENIX, ARIZONA



RYAN AERONAUTICAL CD-119B has completed pre-flight of a light twin across place transport designed the RLC-7. Minimum gross weight would be 3,000 lb. Photographs are 100 hp requirement as to timing engine. Predicted stall speed with full baggage load is 14 mph. The aircraft could take off over a 50 ft. obstacle in 400 ft. and it could land over a 50-ft. obstacle in 400 ft., according to the company.

takeoff, as during cruise prior to landing. In any case, the engine would not be dependent only on boost air during the critical portion of flight.

As for the design, that would be enhanced through a series of tests under 100 psi pressure to the jet pump, nozzles located in ducts in the wings. At the moment the air could be mixed with fuel-oil-rich JP or aviation gas-turbine fuel by a spray plug. Release of the large volume of air compared with the amount of fuel absorbed into the nozzles, it would essentially remove a cold-wall reaction.

Temperature at the duct wall would rise only about 10° although temperature at the exit of the jet pump nozzle would be on the order of 3,000°. When the engine is at the flow rate of air in a system on a small turbine, such as the RLC-7 would amount to 1 lb. of air/sec and fuel used during a typical landing or takeoff would be about 7 gal. Full RLC would be available for 1 min, as actual operation could be employed up to 10 min, with an replenishment during operation.

System Weight

Weight of the system for the light transport would be 190 lb., including compressor (4), storage (100), fuel, ducts and jet pump. Weight more than 190 lb. could be added to the structure of the aircraft because electronic flip mechanisms would not be needed, and the main wing structure could be reinforced, Wagner says. The high aspect ratio wing offers a maximum of reduced drag and would be designed for the air optimum condition—cruise.

Safety aspects of the jet pump system are its eight ejection points. Wagner says. Prime reason for consideration is that it does not depend on air of the propeller engine or on turbo

an engine for power during operation. Pilots always have been critical of RLC systems which depend on bleed air from a turbine or other such device because of the probability of failure while the aircraft is flying at lower than the normal stalling speed.

One potentially hazardous aspect of some RLC systems is spray or ejection. One system tested at Wright-Patterson AFB about five years ago in a modified C-121B had two small jet engines bled in the wings to blow air over the flap. Potential peril in this arrangement was that one of the engines might suddenly quit or that they would operate unevenly.

Other Systems

Other systems on multi-engine aircraft have used bleed air for blowing air on the flaps. This procedure has obvious disadvantages during takeoff: engine failure in flight with an inoperative engine.

In the Ryan system a combination of suction and blowing is used. Air is introduced axially to both wings through a pressure reduction valve and a T connection.

In the RLC-7 two clusters of three nozzles would be used on each wing duct. Air would be blown over the external flap and the suction while the system would be applied to a small wing flap. Airflow would be designed for landing and takeoff. Flaps would be conventional with a serrated chord.

Wagner examines the benefits of having jet pumps located in the wings because bleed air used and the air also operates on a very low pressure. A total of 12 nozzles in the RLC-7 application would have about one gal. of fuel per ton while the size of air flow would be 15 ft./min. Even failure of one duct is quite small

space systems



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In the NASA-developed Driving Belter Observatory launched recently, radiation shield of Mallory 14000 is used in many parts which make outer radiation Part 87 (inherent) shield is shown here

From Mallory imagination in metals...

ideas on miniaturizing radiation shields

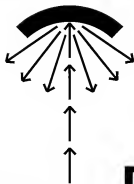
Want to put a lot of radiation shielding in a small space? Our family of high density materials may be just what you need. These powder metal compositions based on tungsten have exceptional abilities for absorbing gamma radiation.

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whose density of 19 approaches that of pure tungsten.

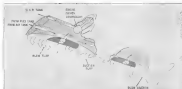
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SCHEMATIC of the pit pump system on the Ryan BUC-7 shows the simplicity of the design (above). Action of the pit pumps at each end of the motion flap supports the shaft in, counter action in the trailing edge of the wing and moves in over the selected flap and allows. High speed into flap and allows to seal. Compressor to recharge the storage tank can be engine or hydrostatic-driven. No power would be required for the BUC system from the engine during landing or takeoff. High wing of the Ryan BUC-7 (below) has a high speed into and is specialized in design for the cruise condition. High wing and T tail placement are necessitated by adverse ground effect which would be experienced during full BUC landing. Engines are set far out on the wings because large diameter propellers are used. Long tail moment arm allows shorter tail section effectiveness at low speed.



not create a fan hazard. Wings used because of the small amount of fuel used compared with the high volume of air.

Also, the cold wet principle of the design changes and ducts could not be likely to upset the motion.

Ignition: Tested

Ignition would be effected by a spark plug in each of the nozzles and this has been successfully tested under laboratory conditions. Within each nozzle is a flame holder, and flame contact to the nozzle by fuel and air. Nozzle spark plugs similar to those used on model airplane gasoline engines were used in the laboratory model.

One possible hazard of the system would be the small diameter fuel lines routed in the wing to each nozzle. Precautions could be given to those by having them carefully checked to ascertain the possibility of rupture during a crash landing.

Stalling speed of the BUC-7 without the lift augmentation would be in the neighborhood of 180 mph because of

an extremely high wing loading. With the BUC system operating, stall speed would be reduced to 34 mph, and approaches could be safely made at 45 mph.

Stability and control considerations of the BUC-7 are not affected adversely by the application of the BUC system. Roll rate and elevator effectiveness are maintained down to stall speed primarily due to the use of the long moment arm.

The surfaces are not eroded for the dimensions of the nozzle, but adverse effectiveness by virtue of the relatively long moment arm wing to tail of the aircraft.

System Conditions

In operation the BUC system could be designed to begin operation as the flap extends to the maximum or might be actuated with a separate control in the cockpit, such as a manual-operated valve actuated by a switch on the instrument panel. Conditions of the system would be indicated by a gauge measuring air pressure in the wing, tank and

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Coil spring view of typical electrical and water assembly



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NOZZLE for the Ryan BUC jet pump is about 3.5 in. long. Jet is admitted through slot at bottom while fuel is fed into nozzle from horizontal line at right. Spark plug is for ignition when system operates. Nozzle is at top. Flareholder opens between main body and nozzle.

possibly fuel pressure in the lines to the nozzle. In the event of failure of the emergency air storage vessel in the air, the craft could be landed without the aid of the system at somewhat higher speeds and longer useful distances.

The Ryan BUC system, aside from being dropped into the BUC-7 light tank, is adaptable to existing aircraft types, Wagner says. The system has applications to much larger aircraft such as V/STOL transports and even Wagner says, the supersonic transport.

One advanced version Ryan is studying employs a combination of active and blowing both on the lower surface of the airfoil. Towing edge action is the combination with a jet on the lower surface of the airfoil achieves increased lift through turning of the stream and by means of the jet stream exhausting through a symmetric slot on the lower surface. Wagner says that such a system has three basic advantages:

- Since the revolution lift increases linearly with the blowing momentum coefficient, very high lift coefficients—above 6—can be achieved at zero angle of attack. This could mean a horizontal attitude for the landing even at very low speed.
- Use of flap time control on the lower surface jet exhaust could make possible a zero pitching moment about the quarter chord through a whole range of lift coefficients.
- Good software damping is possible through use of the flap time control.
- No complicated conventional flap system is necessary.
- Simple construction, adaptable to conventional wing structure. The BUC system has no moving parts.

Ice Cloud Trails Studied by Boeing

Intensity of sunlight reflected from cirrus-type clouds is 100 times brighter than sea reflections from ordinary clouds. Boeing scientists have found from studies of infrared and optical properties of ice clouds formed by steady eruptions of geysers in Yellowstone National Park.

The experiments were part of a study of cloud formations which obscure television, photographic and infrared surveillance of the earth from high altitudes under a \$60,000, one-month contract from AFSC's Space Systems Division.

Ice clouds formed by geysers were similar to cirrus and cirrostratus clouds and the ground study was used as a conceptual plan studying clouds from aircraft.

Scientists described reflections from the plane, less concentrated than sunlight focused at 0 to -30° and scattering circumstances due to "no light we hoped not our instruments detect—much brighter than either we or the Air Force expected." The flatplate crystal collectors also gave some insight on "sun glints," a vertical streak of white light at a 150-deg zenith angle from the sun.

At temperatures as low as -64F, ice crystals were two pieces instead of flat plates. Sunlight reflected from these pieces formed two concentrated spots of light at the same elevation angle as the sun and a 12-deg zenith angle from the sun.

Lightweight Ducting Tested for Turbojets

Experimental lightweight lightweight pressure ducting weighing about half as much as conventional ducting for jet engine exhaust applications, has been developed and tested by the Mechanical Engineering Division of Canada's National Research Institute.

A section of the new type of ducting, 16 in. in diameter, replaced a conventional design during tests of a ductor valve for the division's work on VTOL systems. It was run for more than four hours at a gas temperature of 690C (about 1,200F) with normal deflection of collector but no deflection or testing.

The ducting is made of a reprocessed, partially reconstituted strip of metal alloy steel N-15, a 305-in. thick. It is fabricated first by being rolled into shape rollers progressively elongate slightly less than half the strip width. Then the strip is squeezed longitudinally around a tubular form so that the elongated section wraps over the outside of the



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significant design improvements, especially in the use of lubricants, materials, minor corrosion and assembly techniques.

This step is representative of continuing progress at Garrett-AIRResearch in electromechanical products. This progress created the first 550°F actuators, the first 600°F motors, and points to 800°F motors and actuators in the future.



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smooth action leaving the surface air free smooth. The flat portion of the first wrap lies under the corrugation of the second wrap, and extends far enough to be made the valley of the first corrugation in the third wrap. Seam welding, used to join the duct wrap wraps together, joins two thicknesses along the corrugation except at the edge of the strip, where their thicknesses are joined.

Two sections of this experimental ducting were formed by Bristol Aero-Business, Inc., for the National Research Division. The weight of the ducting was 1.7 lb per running foot for the 16 1/2 in. dia section. That compared with 7.5 lb/ft for conventional ducting used in the first stage of the NRL test of its VTOL engine.

The design and the tests indicate considerable potential for the ducting, and economically further testing of greater duration. National Research also suggests that thermal gages of metal be used, and that different corrugation designs be tried.

PRODUCTION BRIEFING

Eldec-Bernco Corp., Santa Monica, Calif., is participating in engineering studies for the Apollo spacecraft program—including operations, vehicle guidance and control system instructions, data processing and telecom operations—under contract from North American Aviation's Space and Information Systems Division, prime contractor for Apollo.

Martin Co. Nuclear Division has been awarded an Atomic Energy Commission contract to produce the Step 7C nuclear generator for a proposed launch to be located on the moon base. The structure consists of a fuel processor in a moderator in the Step 7 power source made by Martin for the Transit navigation satellite.

Moore checkout telemetry system from 450°F and is being ordered by NASA at the Pacific Missile Range, Ft. Belvoir. Facilities will eliminate need for much mobile and portable checkout equipment. The \$164,000 system is to be completed in July.

Locking Division of Avco Corp. has received a \$5,914,450 contract from USAF's Acquisition Systems Division for production of additional T41E-5 gun barrels against the Avco's four-barrel T41E-4 Chaco helicopter.

Kaiser Coleman Co., Lynch, has manufacturing, working parties with Sol Airtech and precision engineers, has developed a new test for the Canaveral ground. The walls are fired with anti-

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USAF's 624A Tests New DOD Policies

By William H. Gergely

USAF's 624A Standardized Space Launching System that includes the Titan 3 booster—the first stage Air Force system that will use innovative type contracts from inception—represents an especially high degree of Defense Department involvement in system acquisition and management.

DOD's heavy interest in the program stems from 624A's real blessing into management policy areas such as improved cost estimating, reduction of design changes and effects that DOD and the military departments are struggling.

System package plan for 624A, which includes a three-pull integrator, transport and launch facility at Cape Canaveral, Fla., and other test facilities at Edwards AFB, Calif., was presented to Defense Research and Engineering 10 days ago. The plan had been delivered to Air Force Systems Command headquarters and to the Pentagon Apr. 30—the date due for its submission.

Phase 1 of the program, which is titled system definition, establishment of the project organization structure and final cost estimates as objectives set by Defense Research and Engineering, has full DOD approval, but approval of Phase 2 for beginning of formal development must yet receive the go ahead from Secretary of Defense Robert S. McNamara. The government has in-

cluded no costs for Phase 2, though contractors may have spent company funds for research programs.

The Phase 1 objectives, including submission of the package plan and selection of Phase 2 contractors, have been completed. Total cost of the package program is estimated in the \$1-billion area.

What appears to be significant in selection of contractors, United Technology Corp., for example (AW May 14, p. 37), results from the lack of DOD approval for Phase 2. Only Martin Marietta Corp. and Aerojet-General, contractors for the Titan 2 cuts, participated in Phase 1 of the program.

When the Phase 2 go ahead is received—and a decision is expected in the next few weeks—the Air Force will be able to stop the letter contract stage and be ready to sign highly defined contracts.

The system formerly was called Titan 3, but this name is considered a misnomer since it implies, in a follow-on Titan, an intercontinental ballistic missile, that is not now part of the formal plan.

The project organization, as seen in the accompanying chart, sets the associate contractors within Air Force Aerospace Corp. program management. Col. Joseph S. Depewert, as deputy for 624A in Air Force Systems Command's Space Systems Division, is system program director.

Proposed associate contractor organization for Phase 2 is well along, with only the transfer stage (USAF calls it envelope) motor contractor yet to be chosen. A competition is under way for the latter, with entrants including Aerojet-General, Bell Aerospace, Rocketdyne, Thiokol and United Technology (AW May 7, p. 23).

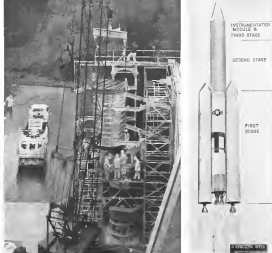
Space Missions

Payloads of 5,000-10,000 lb could be placed into orbit for various space missions with the booster, whose configuration has changed somewhat since it was first conceived (AW May 8, p. 37). Principal change has been the transfer stage added to the Titan 2 core. It is less than half the length of the current 52 ft Titan 2 second stage. It will have two perigee-mounted 5,000-lb thrust nozzles, and no start capability.

A subentry module, including such payloads as guidance, flight control system, telemetry and secondary power, is at the top of the transfer stage.

A standard shroud for any payload 10 ft or less in diameter—the diameter of the Titan 3 second—will be available, but subentry of the core can be made for larger payloads if required.

Launch complex proposed for Cape Canaveral would be north of Satpan pad No. 39 and consist of pads 40, 41 and 42. A runway from the Cape would extend into the Banana River to a solid-propellant rocketing field.



ADDITION of transfer stage to the Titan 2 core has changed the configuration somewhat of the Air Force 624A boosters (Titan 3, shown in artist's conception right). Transfer would have two 5,000-lb thrust nozzles and an interentry module at the top. Top of solid motor motor dropped to the Titan 2 core can be visualized by comparison of the drawing with a 1/6 in. segment being prepared for test (photo) by UTC, contractor for 120A motor for 624A. Drawing shows proposed arrangement solid motor configurations.

ing filled land site with adjacent large docks for delivery of the ball radius period solid motor. A solid motor site building also will be located here.

Contractors from this building would extend northward to a second runway and a building for mating of the solid motor to the Titan 2 core. Classroom from this site would extend to the pads, two on the Cape and one on a reclaimed land site. Roll road tracks would be provided for transporting the elements of the system.

Concept for 624A and its integrator, transport and launch system stems from USAF's Phoenix studies (AW May 31, 1967, p. 38), from the Doan-Sherer project, from Institute of Defense Analysis studies DDOL-A-E studies and the Colson memorandum report (AW Nov. 4, p. 36). The program began its take formal shape last September on the basis of a letter from Assistant Secretary of De-

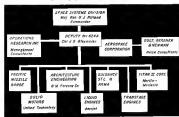
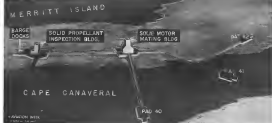


CHART shows USAF Aerospace 624A management and associate contractor structure.



PROPOSED integrator, transport and launch complex at Cape Canaveral for 624A includes barge docks, solid motor inspection building and solid motor storage building (left), solid motor and launch mating building (center), and docks to these launch pads. Use of reclaimed land sites for buildings and pad 42 is indicated.



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Aviation Week Pilot Report

Rugged Skycoupe Shows Ease of Handling

By William S. Reed

Riverside, Calif.—After more than 10 years of producing light and plane for construction of home-built aircraft, the Stits Aircraft Co. has designed, built and plane to produce a sophisticated two place, high wing light aircraft for sport, utility and student flying. The Stits Skycoupe is exceptionally rugged and is an almost completely bolted plane for a conventional aircraft plant.

But Stits, designer and builder of the Skycoupe, is well known among the 10,000 plus amateur and home-built aircraft enthusiasts in this country as well as a good number abroad.

Company Background

He formed the Stits Aircraft Co. in 1918 after designing and building, as a hobby, the Stits Skycoupe. It is the world's simplest aircraft with a wingspan of 7 ft. 3 in. Stits then, Stits has designed and built the one and two-place Stits Pacer, for which 1,500 sets of plans have been sold. The Pacer II, 100 sets of drawings, and the Skycoupe, for which he has delivered 120 sets of drawings for home construction.

Four years ago Stits redesigned the Skycoupe so that it would be more suitable to future production than its home building. Original owners of 18 months for Federal Aviation Administration was extremely enthusiastic. The program required nearly four years

to complete. Biggest difficulty in completing the Skycoupe was that all the aircraft Stits had produced previously were licensed under the "Experimental Category" and as such were allowed wide license by the FAA.

Producing an aircraft for licensing under the "Utility Category" is an other matter, and much more strict regulations must be complied with.

Using the Stits Skycoupe as a sample as a non-reflexibly modified aircraft can be. Pilot controls consist of dual foot-mounted rudder pedals, the top one over a wheel, and dual rudder pedals. A push-mounted throttle is in the center and on the floor between the seats is a hand-operated wheel brake and elevator trim wheel with indicator.

The demonstrator Skycoupe was equipped with full panel instruments driven by engine-mounted. Vibration isolator plus a VFD radio receiver-transmitter. As a color, previous Stits had installed shoulder harnesses integrated with the lap belts, all built according to the previous building structure.

Powering the 100hp Continental O-200 A engine is accomplished with an electric starter. Testing is made easy with the nose wheel linked to the rudder pedals. This three-way visibility on the ground is adequate, and the degree of movement of the nose wheel provides a very short turning radius for

ground maneuver in cramped spaces. Rough terrain is no hazard for the Skycoupe. Landing gear, featuring a two piece spring steel main gear and a rugged nose gear with an integral fairing, is especially designed for rough terrain. Field from which the Skycoupe was flown by Aviation Week had some very rough parts over which the craft was forced to test this feature.

New Wheel Response

Takeoff is performed in a conventional manner, steering performed by a combination of nose wheel and rudder. Response of the nose wheel to rudder response is much better than the demands of control so that directional control is accurate and positive. There is no tendency for the craft to yaw when the nose wheel lifts off nor does it require large amounts of right rudder when the nose wheel leaves the ground.

Method of rotation is at the pilot's option. Aircraft can be run on the ground until flying speed is attained or the talent can be started with the control stick held back. Little technique is required because there is not much danger of rotating too soon or too late or otherwise, giving the aircraft into a compromising attitude.

Climbout is made at 60 mph, and although the altitude is not steep, over-thrust visibility is improved because of a rather high-mounted instrument panel. A color emblem on the tail

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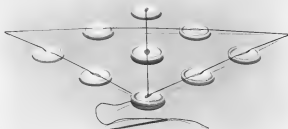
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Assistant Director,
Check-out

It will drive the development of modular open vehicle system checkout systems that will meet overall project requirements. That you will have a system checkout design strategy and specifications create compatibility of the checkout equipment. Design developed by manufacturers with system objectives as well as define the design and development of an integrated system checkout equipment for applications.

The research implies at least a 50% to 60% cost reduction in checkout equipment requirements.

Assistant Director,
Reliability Assurance

The full human laboratory protocol will appear within a year. *Strenuous physical work: measures for reliability* will remain largely unaddressed, and should a more systematic effort at this time.

Researchers should have at least a BS or MS in Behavioral Engineering and tax person-level expertise to observe or communicate within a given reliability situation (individuals).

Assistant Director,
Helm Building

You will be responsible for the implementation of a program to ensure the integration of the health care system within the current development program.

Health impact is less a $WU \approx 100 \approx 100$ Approximate Engineering and two years experience in the field or non-academic health care implementation and

Direct post locality is well-known in
Journal of Neural Systems Sept. 1991
 2:114
 (Kawaguchi et al. 1991).

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LETTERS

'Old World Service'

Ronald McClellan and Otto stand on the rooftop near the May 7 post (p. 144)—that American-owned traffic has dropped significantly on international flights since foreign carriers are expanding and growing at an unprecedented rate. These letters support the "easy" provision of licenses the federal government is now trying to justify granting at once.

The letter overlooked the key issues for the decline of travel on United States international flights—poor service to non-passenger with foreign carriers. While some airlines are not as good as others in this respect, it is very good to compete with the foreign carriers.

American fliers to receive good service but have to pay it.

On my last international flight, I went one way by an American carrier and one way by a foreign carrier. The choice being due to scheduled times of departure. Service on the foreign carrier, from time of making reservations, ticket office handling baggage and on flight was far superior to the American carrier. Apparently a lot of United States' citizens had the same view according to all statistics. At a neighborhood in San Francisco, I would not be competing foreign carrier if I could collect one customer and good review.

The carrier-led American airlines give "old world service" and that was it being left empty airplanes.

Gregory G. Warren
Lafayette, California
St. Louis, Mo.

Small Business Bind

Today the Denver Post named an owner with Irving Manning, Deputy Attorney General in charge of Procurement and Technical Assistance for the Small Business Administration. Mr. Manning expressed his feeling that "procurement" and contracts may not supply the methods and electronics used. He said that he was not going to get a greater number around Mr. Manning. Mr. Manning went on to say "They have spent up in Cape Canaveral and Los Angeles, and they should have spent up in greater southern in Denver."

He made it clear that he was not really to make it clear to the procurement community, but "this is a pretty deep govt. for you that will bring you business into the Denver area."

It seems to have caused Mr. Manning that the small firms that have sprung up at the Cape and in L.A. are business rich. Although contractors in the area. When they moved to Denver, and then to Texas and Minnesota where Reagan placed in Tulsa. They just got the stimulus to the plant, hence, or put into debt. Not matter in every enterprise will spring up in a dislocation situation like Denver or Seattle. They know the when Department of Defense take back as they see where they will be the best to find the out.

Defense Week celebrates the epidemic of its readers on the same subject as the magazine's editorial columns. Address letters in the Defense, Defense Week, 2300 W. 42nd St., New York 36, N.Y. Try to keep letters under 500 words and use an address. The letters will not be printed unless they are, but some of them will be published on request.

as these papers stretchers by pulling with back. And then not a plant near door that needs 2 windows, 1000 YLR machine work at 90000 industry counts.

If Mr. Manning is a single the David Hammer on the New Frontier hasn't compared and the federal system are still being to tell the old gov how to run the thing. That's why it's assigned to keep open mind. Would you like?

(Some withheld by request.)

Marlene
Lafayette, Colo.

B-70 Program

Since Richard A. Woods in a letter to the Editor in the April 5 American West (p. 141), advised that the B-70 program should be cancelled, I feel that it is a matter of opinion should be "Why?"

The only significant advantage the B-70 would have over the B-1 is a greater possibility of penetrating enemy defense systems. However, the next question is, would the B-70 with its one mission range be able to make more air to air penetration than the B-1? The answer is that the B-70 with its low speed would have greater penetration power, and would not make less than the B-70. The high speed conventional and high speed existing surface of the B-70, however, in the enemy territory, will be vulnerable to intercept by a brilliant missile, such as the anti-aircraft missile, which would be released before reaching missile launchers. The only real advantage the B-70 had was a questionable reconnaissance capability.

The Administration's decision to develop a few B-70s for reconnaissance could be based on this need. Actually, up until now, no external weapons are necessary for the program.

Congress appears to be unable to intelligently evaluate a statement by an Air Force general (whose views are reflected by many) for the good old days of not being up when the missile launchers were the key to victory, when he said that the B-70 program was the B-70 program and the B-70 program was the B-70 program.

We already have billions paid up in strategic studies, e.g. The and Project (RBMV), Future submarine launched (RBMV) B-47 and B-51, manned bomber wings, Air Force and Minuteman (ICBM). It would appear prudent to outfit our manned launchers with nuclear missiles at a very natural cost instead of working before the B-70 program.

History has shown that doubling the defense budget to improve various of military equipment which are decisive in a

person we does not necessarily provide security in the next war, e.g. the last study which showed the loss of share of the U.S. defense budget of the 1960s, and the French Strategic Force.

The money would be eliminating another expensive strategic system could very well be used to develop a defense against ballistic missiles, which is an area where we don't see the security of the United States "just" be threatened, we know the security "is" threatened.

DAVID W. CHAMBERLIN
Seattle, Wash.

Space Publicity Policy

Mr. Tice recently gave a lot of money on the part of the U.S. Department of Defense as regards the handling of information said Mrs. Tice. The main effect has been to prohibit release of information regarding the launch and even the name of the vehicle. Surely it makes no difference whether they tell us the status of the satellite, the mission is clearly one of going against the Russians, and each ought to be looking from view as a result of DOD's refusal policy.

The last few satellites which were sent and were not seen from the ground were not destroyed, a parody of even, we could see the satellite. Later they were revealed by the Russians to the Russians, and each ought to be looking from view as a result of DOD's refusal policy.

Perhaps someone could be paid enough to tell us what DOD really has to say for all this.

As we are not doing a lot of the money, then that kind of work is done by the U.S. government. It would seem that the national media is now needed. Editorial, "Send Security Partners" of May 11, 1968.

Up to now I believe the efforts have been limited to our nation's public relations, which may not be the best way to do it. However, but there seems to be a definite intention of late for the military to be in the forefront of the public with "the new news" in the hands of the media at the Cape during the S-11 launch (AFJ 16, p. 15).

It would be interesting to know whether this policy was so loose during the MA-6 mission, when just two days away from the MA-6 first flight 2 was undergoing pre-launch checks. Surely it would not have proved too difficult for a press man to have obtained a picture of the new vehicle by standing by from Cape Canaveral on Feb. 14 to Title 2 on Feb. 16, especially in view of the fact that no photographs had been released of the vehicle itself, prior to its last launch on Mar. 19.

Darrell H. Brown
Pittsburg
Oakland
Oakland
Kent
England

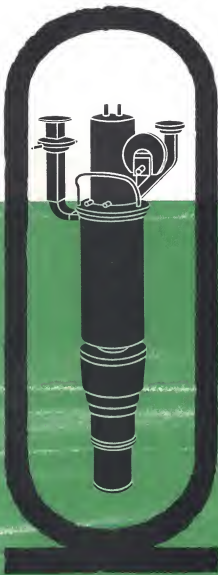
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